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X. *On the Report of the Sub-Committee appointed to consider the question of writing Oriental words in Roman Characters.* By W. H. Bayley, Esq., M. C. S.

I have lately received a printed copy of the Report of the Sub-Committee appointed to consider the question of writing Oriental words in Roman characters, and as a Member of that Sub-Committee I request the consideration of the Society to a few observations which I have to make on that Report. It was prepared by Mr. W. Elliot after Mr. Norman and myself left India, but as we had previously consulted together (not as fully as we would have done had health permitted) and had each written a "memo." (mine is in pages 29—50 of the printed Pamphlet) we authorised Mr. Elliot to append our names as soon as he could complete the Report, which he has most ably accomplished, still there are some points, which either Mr. Elliot did not recollect, or which did not occur for discussion, on which I cannot quite coincide with the Report as it stands, and as it appears that Government have adopted the scheme set forth in that Report, I beg my remarks may be laid before them.

Firstly. I observe that the long accent marks to the Sanskrit and Hindústání vowels e and o are omitted in page 9. It is true, as stated in page 12, that they are *always long*, and if our scheme was limited to Hindústání, there would not be much (though still

some) objection. But when we desire to frame a romanised alphabet to include Tamil and Telugu, it is absolutely necessary to distinguish the long e and o from the *short*, as in the above mentioned two languages there is a short e, and a short o. I think the error must have arisen from a mis-print, and should at once be rectified. I made some observations on this point in my "Memo." (p. 33 of the printed Pamphlet.)

Secondly. I object to the same letter and symbol, namely "'s," being used to represent the Sanskrit श, and the Arabic ص. The Report in p. 7 quotes Sir W. Jones, but he only speaks of a *probable* resemblance, and I think no Oriental scholar of the present day would consider the two letters similar in sound. The Sanskrit letter has a sound of "sh" in it, which the Arabic letter has *not*. It is rendered in Hindústání words by ش (vide Shakspear's Dictionary and Grammar) *never* by ص. It is rendered in Telugu by శ, in which a sound of "sh" is recognized. It is the first letter of such words as "Shiva," "Shudra," "Shrotriyam," "Shaster," thus exhibiting a sound quite different from ص. I would therefore retain 's for ص as the Report proposes, but render श by 's according to the scheme of Sir W. Jones, and most modern Orientalists. I would next point out what I think is an omission in page 11 of the Report. It is admitted that ட்ட in Tamil must be rendered, not with two ds but as ṭṭ; also ற்ற as t't; but no provision is made for ச்ச, which is decidedly—ch, and ங்க=ng, ஞ்ச=nj, ட்ச=tch. I would propose to add these.

I quite admit that theoretically it is a good rule to disallow a second Roman character for the same Oriental letter, and that it is better to *explain* in the scheme that such and such a letter is sounded differently in certain positions, the same as a learner is taught when studying the original language; but still in a Glossary for instance, written in Roman character every one is not supposed to know what the *original* word is. Thus in the Telugu word "pampu" (a field,) the reader would probably pronounce the last p the same as the first, and rightly; but in the Tamil word "pámpu" (a snake), he would not be aware, (unless he knew in what language the word was in the *original*,

that the second p is a decided "b." The Tamil language is peculiar in this respect, as observed by Professor Wilson in the Preface to his Glossary, and I think the Report requires amendment in this matter, as regards the Tamil letters ச, க, த, ப.

With regard to ச I would observe that as an *initial* (I am not speaking of words derived from the Sanskrit) it is not a true sibilant, but something between "ch" and "sh," but more of the former. If I recollect right Dr. Caldwell in his work on the Dravidian languages states that according to theory, it ought to be "ch," and we find its sound well shewn in the words commonly written "Chinna," "Chuttrum," "Chunam," "Chuckler," "Chatty," "Cheroot," &c. On this account I proposed in my Memo. (pp. 31-32 of printed Pamphlet) to render it s̱. The printer has however omitted the infra linear mark, but has shewn it in some of the words in p. 46. I do not propose in this case to use a different letter, but to use a diacritical mark.

With regard to the letters க த ப I propose to use a different letter in certain positions. The Report (p. 11) does not admit this, and I see by Mr. Elliott's Memo. (p. 21 of the printed Pamphlet) that he objects. But I submit that the subject requires farther consideration. As I said before, if the reader always knew, when he met with a word the original of which was Tamil, that is *was* Tamil, the distinction might not be necessary, but in looking for words in a Glossary, how very few people would know what was the original language of the word sought. I have instanced பாம்பு which I think should be written "pámbu." Professor Wilson admits this, and writes காம்பு (waste land) "karambu," &c. I pointed out in my Memo. (p. 32 of the printed Pamphlet) the variations in the sound of ப, த, and க. I would therefore write மாகாணம் (a sub-division of a District,) "mágánam," and முதலி, (the name of a certain tribe of Tamulians) "Mudali."

Had these points been once discussed and *settled* by a majority of the Committee, I would not have urged them; but they were not discussed, and I hope it is not too late to request their consideration, before Government finally determines on a scheme of transliteration.

I do not quite approve either of "x" as an equivalent for the Sanskrit क्ष, for it ignores the "h" altogether, and both Mr. Norman and myself preferred "ksh," as the least of two evils, for the letter does not often occur.

The Report does not clearly state what equivalents are proposed for the Telugu చ and జ. In p. 11 objection is taken to using "ch" and "j" in Telugu words derived from the Sanskrit, but it is not actually stated if "ts" and "dz" are approved. I can see no better rendering, though Rule 3 (p. 3) is broken in both instances, as well as in "ch" for چ, "kh" for خ, "gh" for غ, and "sh" for ش. The Report is also silent as to the mode of writing the Hindústání و when it follows خ. Are we to write "Darkhást" or "Darkhwast," or "Darkhẉast"? I prefer the latter. I conclude that my proposal (p. 43) to render the *hamza* by an aspirate, is approved.

I quite concur in all the rest of the scheme as proposed in the Report, and admit that in some instances it is an improvement upon mine, though the differences are only (except in two cases above named) of minor importance.

I trust that l̲ with the infra linear mark will be retained for the Tamil ழ, and the inverted comma for the Arabic ع. After reading all that is written in the Report and Appendix as regards the ழ I am still of opinion that it is better represented by l̲ than by ṛ, rl, or zh, Beschi is certainly the best of all the authorities quoted. The reference (p. 26) to the 'Sabda manjari' seems decisive. Mr. Elliot I observe leans to Mr. Ellis's "zh," but I have always thought that by English readers this would be pronounced like the z in "azure," and I have found this when I have placed such words as "kizhpák" (the name of a place) "Vellazher" (the name of a tribe) "Tamizh" (the name of a language) "Tázhai" (the name of a shrub) before friends unacquainted with any oriental language. By substituting "l̲" for "zh" in the above words, I have found the pronunciation come much closer.

As to the ع, I see Mr. Elliot leans to the Missionary alphabet

(p. 28 of printed pamphlet.) It is not very clear what they propose. If it is simply a comma above in lieu of the ع, it is much the same as what is adopted, namely an inverted or reversed comma; the latter being preferable, inasmuch as it cannot be mistaken for an *aspirate.* If the example given in p. 28 is rightly quoted I must think it objectionable. The word لعنت is written l'nat. But what has become of the *zabar* before the ع? Shakspeare writes it laˣnat, and the scheme adopted in the Report would write it laʿnat. Again if the above case is correctly quoted the word نعل (a nail) would be written n'l for there is no zabar (or a) between the ع and the ل.

It would be a great convenience if no Capitals were used in writing the Romanised Oriental words. The original languages have no Capitals, and their use is often inconvenient when the diacritical marks have to be added.

I presume that by the Government order of 12th Sept. 1859, it is intended that the scheme set forth by the Sub-Committee is to be adopted in official correspondence, though the wording of that order is somewhat obscure, as it speaks of Sir Wm. Jones' system as modified by the Asiatic Society *and* Professor Wilson *and* the Madras Literary Society, now I believe that these three authorities do not coincide in their modifications, and it requires to be distinctly stated *which* modification is to be introduced.

I would also submit that farther preparatory explanation should be afforded before it can be expected that the servants of Government can carry out their orders. Long usage in a particular mode of spelling is not so easy to cast off at once. I find even Mr. Elliot, in his 'scheme,' constantly writing Sanskrit with a c instead of a k; and in one of the printed letters of 1834, by a distinguished advocate for pure spelling, I find 'Hindústání' spelt 'Hindúst'hání.' Again in a late order of Government which affects the unusual spelling "táluq," (it should be taʿalluq) the old fashioned "Oolungoo" stands out in broad Gilchristian deformity; whilst we have "Mirásdár" and "Carnum" (it should be Karanam) as a set-off against "fusly" and "Sheristadar." Again in the printed copy of the address of the Governor of Madras to Narsingha Ráó, I

find the old spelling Kandy transformed into "Kandi," whilst in the same paper Bellary declines to become "Ballári."

It is impossible for the servants of Government, or any body else, to give the right spelling, even if assisted by a *perfect* scheme of transliteration, unless they know how the word is written *in the original*, and it so happens that *most* of our Official terms, and very many proper names of Pensioner, In'ámdárs &c. are Hindústání or Persian ; languages which hardly any of our Officials know how to read. For instance—the word commonly written "Nuzzerana" (and I do not see that we can find an English equivalent). How few Officials, European or Native, could spell it rightly even with a perfect scheme of transliteration set before them, simply because they do not know how it is written in the *original*. They would hardly guess 'Nazrána.' So with such a name as "Meer Zynool Abdeen." How is a person unacquainted with the original vernacular spelling, to know that it is "Mír Zainu-l-'Abidín"?

In my humble opinion *two* preparatory steps should be taken by Government before ordering a new mode of spelling, 1st, a *complete* scheme should be set forth by authority. 2ndly. Lists of words in most common use, such as Official terms, names of Persons, Places, Months, Years, Tariff articles &c. should be prepared ; written both in the original language, and in the authorised Roman letter orthography.

I submit that no complete scheme *has* yet been set forth. That of the Madras Literary Society is good as far as it goes (with the one or two exceptions I have pointed out), but it would not meet many words of constant occurrence.

It is still a question how the 'hamza' should be noted in such words as امراي an orchard, لايق fit. Should it be 'amrá-í' and 'lá-iq,' or amrá'í' and "lá'-iq"?

For such a word as درخواست (an offer) no rule is laid down as to the و. I should write it 'darkhwást.' So, as to the final h in Hindústání words. There is no rule to show if two such words as درگاه a mosque and نامه a writing, are both to end with "h" in transliteration, or whether one is, and the other not.

It is not stated if Professor Wilson's dictum that to pronounce و like w is an " Indian cockneyism," is approved.

It is also a question not met in the ' scheme' whether words ni Tamil and Telugu *derived* from Sanskrit are to be spelt as written in the vernacular. Is பூமி to be written " púmi" or " b'humi" ? and how as to such words as போகம் பாக்கியம் which in Sanskrit are B'hóga and B'hágya. Is தருமம் virtue to be written D'harma.

It is not stated if the final ' u,' unpronounced in several Tamil and Telugu words such as Anaikattu, Gudáka Pattukattu, Tap-pálu, Purambókku, is to be omitted in writing ; or the final ' an' in such words as Maniyakkáran, Páluiyakkáran, Kávalkáran, &c.

I now come to the 2nd step that I think should be taken *before* Officials are ordered to adopt a new spelling : namely the preparation and publication in the original vernacular, and in the authorized Roman character, of lists of words in common use, to guide those who *cannot* be expected to know how these words are written in the original. There are scores of terms in constant and familiar use, such as

Nunjah.	Banghy.	Lac.	Mootah.
Poonjah.	Batta.	Cowle.	Garce.
Cutcherry.	Curnum.	Shroff.	Olluck.
Mohturfa.	Crore.	Soucar.	Viss.
Pyacarry.	Deloyet.	Jummabundy.	Mercal.

and not one Official in 100 knows how they are written in the original, and few therefore would be able to comply with the orders of Government, unless they give some guidance. The same with the names of Persons in Pension lists, Parwánas, Sanads, &c., a matter often of great importance. How few can be expected to know the way in which such words as the following are written in the original. I give the *ordinary* spelling.

Abdool Cawder.	Zynool Abdeen.
Azeem ool moolk.	Syed oon-nissa Begum.
Imtyazood Dowlah.	Saliya Beebee.
Ebraheem Cawn.	

I have myself known practically the trouble and confusion caused

in tracing the right to an ʿinám, from confounding "Fuiẓu-lla-Khan" a man's name, with "Fázila Khánam" a woman's name; and "Aḥmad" with "Hamíd." Surely "Chowry Mootoo" "Trimul ạ charry" should not be so written: this would be as bad as the spelling of the name "Bhonsala" in our old treaties, viz: "Bouncello', and the stereotyped spelling of "Tippoo Saib."

In the scheme proposed by myself and printed with the Sub-Committee's Report, I gave examples (page 46) of 263 words of common occurrence in official correspondence. The transliteration there given requires to be slightly altered to suit the amended scheme, and then these words would form a useful list. There should also be a list of about 200 most common names of Persons, in Hindústání, Tamil, Telugu, Mahratta &c., and Collectors and Paymasters should send Nominal Rolls in the Vernacular to the Government Office, in order to have every name therein entered, written in the authorised manner for their guidance. Native terms used in the Sea Custom House Tariffs should also be formed into a list; that is if "Cundaloo" is to be spelt "Kandalu" and "Ghee" "Ghí" and "Gunny Ganni, and Godauk Gudáku."

The correct writing of names of *Places* requires consideration. I see by the Government Order that they speak of certain names being as it were stereotyped by long usage and these are to remain. I think the example given of "Negapatam" is unfortunate. There would be little change in writing it correctly "Nagapatam," and if such a word as that is to remain unaltered, it is difficult to see what *are* to be altered. I see in Government papers the new spellings of "Kandi," and "Uʿsúr," surely these are greater innovations than "Nagapatam." Are we to introduce a new scheme of writing Oriental words, and then remain content with such barbarisms as

Curcumbaddy.	Tripetty.
Pulmanair.	Carangooly.
Moolwaggle.	Conjeveram, (absurd stress on the *ram* generally.)
Guzzlehutty.	Chittoor.
Tellicherry.	Cuddapah.
Oolundoorpett.	Streepermatoor.

all of which are stereotyped enough. But then the question

arises, as to what names of places are so spelt *now*, but to write them correctly would lead to actual confusion and inaccuracy. It would not perhaps be asking too much of Government, to expect them to decide, and give a list of *all* such names, such perhaps as Madras, (the proper spelling of which no one knows,) Pondicherry, Tranquebar, Trichinopoly, Triplicane &c.

It should be considered whether Vellore, Nellore, Chingleput, Coimbatoor, Poonamallee, Seringapatam &c. should or should not be correctly written. At all events a list should be made of *all* exceptions.

A correct list of the Muhammadan months should be prepared, and such words as "Rubbee oo-lawl," for Rabí^c^u-l-awal and Jumadisany for Jamáda-'s-'sání repudiated. It might at the same time be made known that the year of the Hijra (vulg Hegirah) is easily reduced approximately to A. D. by deducting 3 per cent. and adding 622.

The list should also contain the Tamil and Telugu years and months; though as regards the Tamil years, it is a question if the Sanskrit orthography should be retained, or the Tamil spelling adhered to throughout. Are we to write "Prijótpati" or "Pirsórpati?" If the latter, is the Sanskrit orthography to be adhered to *throughout?* If so, a correct spelling of each year can only be made out by some one acquainted with Sanskrit. The list should also contain the correct spelling of the Muhammadan and Hindú Feast days. I have seen extraordinary renderings in some official orders as to Native Holidays, such as "Sooberat" for "Shab-i-barát," "Buckreed" for "Bagr'íd," "Audy Pundyga" for "'Adi pandagai." The Madras Constables know the Muharram as the "Hobson Jobson Feast!" from Hasan and Husain, the martyrs celebrated therein.

I now proceed to notice the objection taken to interfering in the present spelling of many words on the ground that they are stereotyped by language, and are secured by a kind of official guarantee in the wording of the Regulations, General Orders, &c. Really if we are to retain the orthography in these cases, we may as well give up the scheme of transliteration altogether, as far as official terms are concerned. If the scheme is to be adopted at

all, it will be against those time-honoured barbarisms that the crusade must first commence. Take the following:

Jagheer.	Cusbah.	Moonsiff.
Polygar.	Zillah.	Mohturfa.
Sunnud.	Sudder.	Sayer.
Cutcherry.	Foujdarry.	Veesabaddy.
Curnum.	Adawlut.	Cutwal.
Cowle.	Ameen.	Sheristadar.
Jummabundy.	Shroff.	
Talook.	Soucar.	

Those must all stand as they are, if long usage and the Regulations are to uphold them.

Again who is to be the judge as to whether any particular word is to be considered "stereotyped"? Opinions will differ. Take the following:

Punchayet.	Puttah.	Cutbaddy.
Dufter.	Teerwa.	Cavilgar.
Daloyet.	Oolungoo.	(This last word in
Lubbay.	Mootah.	Trichinopoly Town is
Tindal.	Annicut.	known as Cow-karra)?
Lascar.	Harem.	
Banghy.	Turrum.	
Cutcha.	Lac.	

Out of 20 persons who had considered the subject, 10 might say they should all be altered, and 10 might say they are *stereotyped.*

I admit there *are* difficulties, but all I contend for is, that it is for those who order a new system to be introduced, to declare distinctly what are *the exceptions*; that there may be no mistake.

Many persons may see no objection to changing "anna" to áná, who would repudiate changing rupee to "rupíya." Then again the coin we call a *pie.* Surely it should be written "páí" thus distinguishing it from the Bengal "paisa." Its plural should be "páís" for to make the plural *pice* is not in accordance with any known language.

There will also be some consideration required as to the Weights and Measures. If "lac" is to be written "lak'h," then "crore" should be "karor." If "seer" is to be "sér," then "olluck"

should be "álákku." If we are to adopt "túm" and "putti" then we should have "padi" (for the Madras *measure* or puddee) and "marakkál" (for marcal.) The word "maund" I believe to be a corruption of the Persian "man" (generally written "mun" in Bengal.)

Besides the word "rupee" the word "sepoy" is one requiring consideration. At one time the "Friend of India" always spelt it "sipáhí" which is correct, and this spelling could not give rise to any error. "Mohur" should be "muhur." "Fanam" in the original is "panam" (பணம்.) Is this to be adopted? Again such words as 'arrack' ('araq) 'chuckler' (sakkiliyan) 'tope' (tóppu) 'chatty' (Satti) 'Toddy' (tarí) 'pariah' (paraiyan) 'choultry' (Sattiram) may by most persons be considered Anglicised and be entered in the list (for I conclude some list must be made out) of *exceptions.* It will not do to give a licence by the word, &c.

I perceive in the printed copy of Sir C. Trevelyan's address to Narsingha Ráó that the old spelling Cutcherry is changed to "Kach'harí." Now after such a reform in the case of one of the most *stereotyped* of words, there can hardly be a reason for refusing a similar reform in the writing of another Revenue stereotyped word "ryot" or the D. P. W. word "jelly," or the Military "Batta," or the judicial "pottah," or the Commissariat "cornicopoly" (supposed by some to be connected with *corn* or gram) or the Marine "catamaran," or the Police "taliary," or the Custom House "maund." Then "parcherry," "cooly" and "dooly" must yield to the innovation, and should not "jastee" be "ziyádati."

P. S.—As "Kandy" is written by authority "Kandi" and "Ossoor" "Usúr," I conclude Vepery should be written "Véperi," and "Mylapoor" "Mayilápúr" and "Perumbore" "Perambúr." If so, should not "Chepauk" be written "Sépákkam," and "Egmore" Elambúr?

I have avoided entering into any discussion as to the advantages expected from transliteration in general. There can be no doubt that for words used in official correspondence, a reform is necessary.

MEMORANDA.

I have looked through Mr. Bayley's objections to the Sub-Committee's Report, and am glad to find that I am able to concur in almost all of them. In some instances I have to plead omission and want of sufficient perspicuity on my own part as having led Mr. B. into error regarding my intention, in others he has overlooked my meaning, but on the whole we substantially agree, and had the draught report received the benefit of his supervision, it would, I am sure, have appeared in a more perfect shape and been free from the objections he has pointed out.

These I will notice seriatum :

1. With regard to the long e and o, I certainly never intended that they should not be distinguished from the short sounds of the same vowels, and I never fail to note them with the accentual mark in practice. I see, however, that these marks are omitted in the tabular scheme at page 9, they should be added in the revised report, and the following sentence should be added after the words " is required for them," at page 12, viz. " the long sounds being distinguished by the usual accentual mark."

2. In taking 's to represent both श and ص I was guided by Sir W. Jones, but I am free to admit that the sounds do differ, and I acquiesce with pleasure in Mr. Bayley's emendation of rendering श by 's or perhaps better by s̠ as being an anomalous sound, and as being less liable to be confounded with the long vowel sound, and more in accordance with the general principle of the scheme.

3. I also bow to Mr. Bayley's judgment with regard to the diverse sounds of the same Tamil letter. His argument derived from the difficulty in which persons unacquainted with Tamil would find themselves has much force. With regard to the initial ச I prefer the employment of " ch" to that of s̠. The former has the sanction of Dr. Caldwell and is most in accordance with general use. In the event of substituting " c or ç" for " ch" in the Sanskrit alphabet, the same expedient should be followed here.

4. With regard to the use of " x" for " ksh," this point was discussed and forms one of the articles agreed to and recorded in the Memo. drawn up the day before Mr. Bayley sailed. Mr. Bay-

ley then expressed the same objection he does now, but conceded the matter in consideration of the gain on the side of simplicity of notation.

I consider therefore that this adaptation should stand.

5. I regret that I cannot give in my adhesion to the use of "ts" and "dz" for the Telugu చ and జ and that for the reasons adduced in the report. The people themselves do not make any such distinctions in their system of notation and have no difficulty in catching the proper sound in practice. This case differs, I conceive, from the partly analogous use of Tamil, because in the latter the alphabet is actually deficient in the normal sounds required, whereas the Telugu alphabet is complete and the circumstance of two letters being liable to certain varying shades of pronunciation should not, in my opinion, lead to the adoption of additional signs to represent such differences.

6. I have no objection to Mr. Bayley's additions in respect to the letter ژ but I see no advantage in having a diacritical mark as in the word dar<u>kh</u>wast.

7. A reference to the para. at p. 13 and to the scheme at p. 16 at which the letter ழ is discussed will show that it is prepared to be represented by ?̱ as Mr. Bayley desires, and that no reference is made to the substitution of "zh."

8. At p. 15 of the Report, Mr. Bayley's scheme for writing ع is distinctly recommended for adoption, and it is only added that the Megsis plan is deserving of commendation. Mr. Bayley's remarks refer to my Memo. which was written long before we had any discussion or before I had read his or Mr. Norman's schemes.

I should have been glad to have seen the continuation of Mr. Bayley's paper and with reference to it and to the foregoing remarks to have prepared a revised edition of the report. This I may perhaps have the opportunity of doing in combination with him at home.

WALTER ELLIOT.

XI. *Report on the Management during Fusli* 1268 *of the five Laccadive Islands.* By E. G. Thomas, Esq., M. C. S.

(Communicated by Government.)

1. The following are the few circumstances concerning the former state of the Island and people of Menakoy which I could learn from the Islanders, much more might probably be learnt from the Beebee of Cannanore or the Sultan of the Maldives, if either of them chose to be communicative : a written history of considerable antiquity was accidentally destroyed in the Island some years ago by fire.

2. The Islanders are Musselmen of the "Suny" or "Safy" sect.

3. Their language is that of the Maldives Islanders, and is found in no other country though there is a great resemblance between it and the Cingalese ; in religion and all domestic customs also they say there is no difference whatever between them and the Maldive people.

4. In the Maldives there are many songs commemorating the struggle that took place there when Mahomedanism first entered as elsewhere by the sword, and it has now been the exclusive religion there for about 500 years.

5. There are no recollections of such a religious struggle in Menakoy, and the Islanders therefore (believing that they undoubtedly first came from the Maldives the nearest land) date the occurrence somewhere under 500 years ago.

6. There are some small subterranean passages in one corner of the Island, of the history of which the present inhabitants are quite ignorant, and which probably served as places of refuge to a former race who lived here at an earlier period.

7. I could obtain no account of the way in which, or the date when, the Beebee of Cannanore got possession of the Island : she is said to have assumed the position of proprietor as well as Sovereign of the Island on the occasion of the murder of one of her agents, and she now owns by far the greater part.

8. It is said that her sway over the Islanders was more powerful and oppressive before than since she was conquered by the

English; from that time the people have assumed to themselves more independence.

9. A considerable change was wrought in the relative position of the Beebee, and the people on the occasion of a quarrel 30 years ago between one of the Beebee's Captains and his crew; the latter mutinied and the matter having been referred to the Beebee's agent on the Island, the people clubbed together and refused to tolerate his interference; from that time the Beebee's power here has been more of influence than of despotic authority, this however, from a discreet use of the power of obliging or disobliging them given her by her landed possessions there, and by the number of appointments which she held out for sailors, pilots and captains in her various vessels, has always been very considerable.

10. About the year 1850 the crews of some of the Islanders vessels, on the return voyage from Bengal, mutinied at Galle and refusing to touch as desired by the owners at the Maldives sailed straight back to Menakoy: the merchants represented to the Beebee that if their trade was liable to be thus interfered with by sudden freaks of the populace, their profits would be small, and they would be wholly unable to comply with the Beebee's occasional calls for loans, and the Beebee therefore ordered the sailors to appear before her at Cannanore: the order was disregarded, and an agent (Soopy Kooty) being sent to the Island had many of the people flogged with a cat-o'-nine-tails and many fined; the Beebee at the same time levied a loan of Rupees 200 each from several of the merchants.

Physical Description.

11. Menakoy is a coral Island with the usual characteristic of such places; a mass of coral about 5½ miles in diameter (5 from

NOTE.—Nearly all the small and some of the larger vessels in the Island are built from remarkably hard, strong old cocoanut trees found on the Beebee's property and on no other parts of the Island. The boats are chiefly pegged and the wood for these pegs, for the knees, &c., and the rollers on which they are launched and drawn up again are taken for the most part from the Beebee's land with her permission, as also are firewood and much fibre for ropes from a jungle tree.

The monthly payment of cocoanuts to those who collect her nuts for her is a great source of support to them.

east to west and from north to south) has risen from the depths of the unfathomable ocean apparently almost in a columnar form, and appearing above the water in an oblong shape, forms an Island on the east side with a large lagoon encirled by a reef to the west of it.

12. The Island at the broadest part is less than a mile in width, the lagoon is about four miles broad and 5 long.

13. The reef for about $\frac{1}{2}$ of its length is visible at low water; over the northern $\frac{1}{2}$ of the reef there is never less than 2 or 3 feet of water: near the south end of the reef an Islet* has been formed on it about 100 yards square; at the middle of the reef there is a small barren Islet 20 yards square; near the north end another small barren Islet 10 yards square was thrown up in 2 fathom water by the storm of 1847.

14. The reef consists of flat rocks, 20 yards in width with stones, large and small, loose and connected, sometimes covering, and sometimes sparingly scattered over it: the water very gradually deepens on the outer side for about 100 yards where the coral formation ends with a precipice. On one side of a boat may be seen the clear white bottom with rocks and fish; on the other deep blue sea; within 100 yards of this it is said that frequently there is no bottom to be found: this appears to be still more the case on the east side of the Island.

15. There are 3 entrances to the lagoon only one of which, that at the west, is adapted for large vessels; over this latter there is at low water 2 fathoms and in ordinary high tides 3 fathoms of water.

16. The depth of water within the lagoon is very various, about $\frac{1}{4}$ of the lagoon is less than 6 feet deep and much of this only 3 or 4; there are large portions with 6 and 7 fathoms of water; a white coral sand covers most of the bottom of the lagoon; small rocks however abound in parts, and here and there rise precipitously to near the surface; they are composed of living coral of numerous shapes and colours, and often spring from the bottom of sudden hollows of 7 fathom water where the neighbourhood is only 1 or 2, and in these cases the angle at which the sand stands is astonishing; the sand sides of these pits being frequently hard-

* There are about 50 Cocoanut trees on it.

ly out of the perpendicular for 20 or 30 feet: the water is so clear that every movement of fishes, turtles, &c., even the eyes of large fish may be seen without difficulty in 7 fathom water.

17. The lagoon abounds with turtle, a large skate (called "Terendy" on the coast) and many fishes fit for food.

18. In 2 hauls of a large drag net 14,000 yards long 53 turtles and many fish were taken.

19. The usual anchoring ground is outside the west entrance where there is a bottom of flat rocks and sand for a distance of about 200 yards very gradually deepening.

20. It is the opinion of the inhabitants that no changes whatever take place in the depth of the various parts of the lagoon and that no new rocks are formed; I found the coral insects however alive and at work within the lagoon.

21. The Island of Menakoy is about 5 miles long, and in the broadest part $\frac{3}{4}$ mile wide, the north $\frac{1}{2}$ of the island is a very narrow strip very gradually widening from 20 yards to the width which it assumes within $1\frac{1}{2}$ miles of the south end.

22. The north end extends in a point considerably beyond the reef out into the sea and is therefore considerably exposed.

23. No changes in it have been noted by the people.

24. The accompanying sketch may give some idea of the shape of the island and lagoon, &c.

25. The soil of the island consists of coarse powdered coral with a slight admixture of vegetable matter.

26. The greater part of Menakoy is quite flat and so near the level of the sea that water may usually be found at depths varying from 1 foot to 6: the water though a little brackish does not seem to be unwholesome, as the people are generally healthy and seem to have an ordinary average of old people among them.

27. The overlying flat rock commonly found in the Laccadives has been removed at an unknown period from large portions of the island, and heaped up into a long ridge 25 feet high, and $\frac{1}{2}$ a mile long parallel with and close to the east side of the island; the material thus removed has also formed numerous other mounds of which one (about 35 feet high) is the highest point on the island. Towards the south end of the island as well as in the north,

I am inclined to think this overlying rock never existed, for there are no mounds whatever, yet water is within a foot of the top; there is no rock to be found on digging and in one part 200 or 300 yards square of land is so damp and marshy with a pool in the middle of it that it is with difficulty traversable.

28. The cocoanut trees in this part are weak and not very productive.

29. The overlying rock where found is usually only about 6 inches thick and is a kind of concrete composed of sand with bits of coral and shells.

30. I sunk a pit in a part of the island of more recent formation and found loose sand for 10 feet, then a stratum of rather coarser sand and under this at about 12 feet from the surface a layer of detached bits of flat sandstone apparently in course of formation into a flat sandstone rock: there was moisture here and water 2 feet below.

31. There is no part of the island destitute of trees; in the south portion it is thickly covered with jungle and cocoanut trees; in the north more sparingly.

32. There are no dogs on the island, rats abound to the destruction of cocoanut plantations; also cats, 3 or 4 cows and as many goats, no snakes or scorpions, curlew, sand snipes of various kinds, a large grey crane and a water hen stay there, and golden plovers and teal sometimes come there in flocks.

33. Mosquitoes abound to such an extent as to make sleep quite impossible to either Europeans or Natives except under curtains or in a thorough draft, and even then so unusually poisonous and pertinacious are they, that nothing but the greatest care can procure one any peace, the moment the sun is down they are out in such numbers that no sedentary occupation can be pursued unless every limb is covered with 2 or 3 folds of cloth or muslin, thick trowsers and socks are no defence; they are bred in the pits in which the husk of the cocoanut soaks for 6 months preparat ry to being made into coir.

34. Though no changes have been noticed in the depth of the lagoon very considerable ones have taken place and are still doing so on the west shore of the island.

35. Annually a portion of the shore near the north end and within the lagoon is washed away and deposited on the shore near the south end, also within the lagoon 10 or 12 feet of ground in width and about 200 yards in length, with the cocoanut trees growing on it, is thus annually removed from the narrowest parts of the island, and, if this continues at the same rate for 10 years more, this part will probably have been wholly washed away and the island will be of a far more round shape than at present.

The storm which devastated the Laccadives (in 1847) burst through the north strip of this island at a spot 100 yards from the end, where it is 31 yards wide, and 3 yards high, in a year or two the sea ceased to flow through and it has since thrown up a bank of stones, the same storm formed a small islet near the entrance to the lagoon.

36. At the south east corner of the island among heaps of coral stones (which appear to have been but little broken up or disturbed since placed there by the sea centuries ago,) and in the jungle where there are few cocoanut trees, there are some small chambers which have been constructed under ground at an unknown period, most of them are about 4 feet high, 3 wide and 10 or 12 long, many are smaller, they are but little removed from the surface; the walls (like most others on the island) are built of loose flatstones laid one upon another and at the top of the passage they are made to approach each other and form a kind of arch, over which are laid large flat stones and over this 3 inches of loose stones, no bone or other trace of man has been found in them except a folded up sack which crumbled when touched (I could learn no particulars of the nature of the sack) and the shells of a kind of fish which has been eaten from time immemorial by the people of the island, there are about 50 of these, and it may be surmised that they were used as temporary places of concealment during incursions of pirates, &c , time has not in any way cemented together the stones above and around these passages or holes.

37. *Winds.*—In $\frac{\text{Karkadajim,}}{\text{July}}$ $\frac{\text{Singam,}}{\text{August}}$ $\frac{\text{Kannee,}}{\text{Setpember}}$ the wind is from the west, rather squally, with showers: In $\frac{\text{Tholam}}{\text{October}}$ and $\frac{\text{Vrishigom,}}{\text{November}}$ it blows from all four quarters. In $\frac{\text{Thanoo}}{\text{December}}$ and $\frac{\text{Majarom}}{\text{January}}$ from east and north-east with showers in some years. In $\frac{\text{Kumbah,}}{\text{February}}$

$\frac{\text{Menom}}{\text{March}}$ and $\frac{\text{Meddom,}}{\text{April}}$ from north and north east. In $\frac{\text{Edavom.}}{\text{May}}$ $\frac{\text{Methoonom}}{\text{June}}$ and $\frac{\text{Karkedagom}}{\text{July}}$ monsoon and storms from west and north west, water spouts frequently in Edavom and Midoonom.

38. *Current*.—In Edavom, Methoonom and Karkedagom goes south east passing south of Ceylon and going to Pulo Penang and beyond Kannee, Tholam and Vrishigom current less violent, and direction uncertain; close to shore changes will be rapid several within the day; but not so rapid at sea.

39. In coming from Maldives to Menakoy in $\frac{\text{Kannee.}}{\text{September}}$ steer four points west of Menakoy to hit it.

40. *Population.*—The inhabitants of Menakoy (about 2500 in number) bear the different class appellations of Malikans, Malummy Yàekurā, Kalo, Maylacherry, no great distinctions however attached to all these names.

41. The real divisions are Malikans, Malummies, Klasies, Maylacherries.

42. The Malikans (about 116 in number) form the aristocracy of the island; 3 of them have considerable landed property there, and own all the trading vessels which go to Bengal, &c.

43. Though now consisting of several families they are all connected, being sprung from Kambakoth Kombaramy who lived 200 years ago.

44. They have by no means the overweening influence exercised over their countrymen as by the aristocracy of the Laccadive Islands, this is consequent on the different relative position of the parties.

45. The Beebee of Cannanore has endeavoured more or less to identify their interests with her own by supporting their wishes occasionally with reference to the conduct of their sailors, and by usually employing one of them as her agent or Konnakar on the Island.

46 This Konnakar collects all the revenues of the Beebee, levies fines for trespass, keeps down in a measure theft, &c., and superintends the Beebee's traffic, i. e. on the arrival of her vessels from Cannanore he gives orders necessary for their careful preservation and arranges for the embarking of the cargo, crews, &c., for the voyage to Bengal at the commencement of the season.

47. Formerly they had the exclusive privilege of wearing good cloths, caps and shoes and using umbrellas, but every one now wears what cap and cloth he likes and Malummies use the umbrellas also ; the shoes is the only remaining exclusive privilege of the Malikans.

48. They live with their families in large low rambling houses within court yards and possess English Quadrants and Compasses, Charts and Telescopes.

49. The *Malummies* are the pilots and mates of the vessels ; this is no hereditary title but is conferred by their neighbours for ability : any man in Menakoy may obtain this rank and is not then excluded from the society of the Malikans who will even intermarry with them, they number about 180.

50. The Klasies (1,107 in number) form the bulk of the population, and though in general poor are exceedingly independant of the other classes : they possess no sea-going boats or vessels of their own, nothing fit to use far outside the lagoon ; but they work the larger vessels and the Massboats of the Malikans, as it is impossible for the merchants without their aid to carry on their trade and as the "Klasies" are not landed tenants at will as in the Laccadives but with very few exceptions, small land proprietors themselves and only going to sea for regular wages given for work done at the time, they enjoy a very comfortable independant position and both on land and at sea yield by no means implicit obedience to either Beebee or Malikans.

51. Besides those who are employed in the Beebee's and Malikans vessels many of them take service in English ships and are absent for many years together ; during this period they get high wages but usually spend it all before they return to Menakoy; they were formerly more wealthy being generally able to lay out a little capital in trade on their own account every voyage, but taking to imitate their superiors, and living and dressing beyond their means, they have of late years become thriftless and poor.

52. Through these sailors not a little information has found its way into Menakoy regarding Arabia, Africa, Bengal, Malacca, Australia, &c.

53. Those who follow the occupation of *Maylacherries* or tree

climbers are about 583 in number, they climb the trees of the ryots and the Beebee for hire and extract the juice from which sugar is made.

54. The whole population of the Island is congregated in one spot and live chiefly in detached enclosures forming long sheets of cocoanut leaf hedges, and leaf thatched houses ; the arrangement is to enable the Beebee to guard the better against trespassing on her cocoanut plantations.

55. In the North and South portions of this village there are head men who have been elected by the people and another over these two is elected by themselves and approved by the Beebee of Cannanore.

56. Whenever proclamations have to be made known to all the people, or they have to be assembled for any work, these "Moppans" (head men) are always the persons through whom they are communicated with and as might be expected have considerable influence with them.

57. Occasionally there have been outbursts in which the usual tyranny of a mob is shown : those who do not answer to the peculiar call which is used for assembling them are punished sometimes by having their court-yards filled and houses heaped up with wild pine apple brought and flung there by all their neighbours, and it is a labor of many days to them to rid themselves of the nuisance, on more serious occasions of public displeasure, the house is looted and pulled down.

58. The people of Menakoy while at home are as a rule very idle. Active sailors and traders they come home to take their ease, and leaving the women to soak the coir and pick up cocoanuts, cowries, &c., they only condescend to bestir themselves when there is a chance of catching massfish ; their physiognomy is not all that of the Malabar Moplahs or that of the Laccadive Islanders: there appears to me something African in some of them; having never seen Maldive people I cannot say whether they resemble them.

Islanders' property.

Barque	1
Odies	7
Bandodies	2
Mass boats	8
Boats	31

59. It is worthy of note how large a number of the people the Beebee keeps in some measure dependent on her.

60. In her 3 " Odies" and 1 Barque she employs probably about 100 men monthly: she pays (for collecting the fallen cocoanuts) about 400 women and for various odd work 50 youths, thus about a quarter of the population receive more or less from her.

61. The following are the chief products :

Cocoanuts,	Mean Shakrai,
Sugar,	Arreca Nuts,
Coir,	Betal vine Shalam Maze,
Cowries.	Warrago,
Mass fish, Shark Kotah	Sugar-cane, Plantains,
Terendy (large Skates),	Edible root, called " Hithala Kilang."
Turtle,	

NOTE.—A Barque of about 400 tons and " Odies" under 200 tons : the smaller vessels " Bandodies" are of about 70 tons burthen.

62. *Trade.*—The people of Menakoy are great traders. At the time I visited the Island all their vessels but 2 were absent, and it was not very readily that they informed me how many they had. I believe, however, I shall not be far wrong in saying they have 6 or 7 vessels fit for the Bengal trade, and 3 or 4 which go to the Coast and the Maldives.

Beebee's property.	
Barque	none
Odies	3
Bandodies.......	3
Mass boats.......	3
Boats	none

63. The usual course of trade is as follows :

They go with money and sometimes (but rarely) with mass fish and sugar to Goa for salt, and to Mangalore for rice, returning with these to Menakoy, they usually transfer the goods to a larger vessel and start laden with cocoanut, coir, sugar, mass, &c. for Bengal : they usually touch at the Maldives and Galle on their way ; to the Maldives they take Goa salt, Menakoy sugar and (if any remain from last year) Bengal rice and Coringa cloths ; here they take in mass for the Galle and Calicut markets, cocoanuts, cowries and coir for Bengal, at Galle they take in more cocoanuts and sail for Calcutta.

65. On the returning voyage they bring from Calcutta (for sale in the Maldives) cloths, silks, &c. and sugar from Balasore, and Oomrah, &c. (for sale at Galle and in the Maldives), rice from Coringa (for home consumption and the Maldives) white cloths, &c.

66. The Menakoy trade and its profits are both said to have greatly diminished of late years. Formerly they had 10 "Odies" and a ship burnt: now they have 7 "Odies" and a smaller barque: they once traded to Mauritius, Arabia, the Persian Gulf, Maulmain, and Singapore; they now seldom go any where but to the Western Coast, Maldives, Galle, ports on the Eastern Coast and Calcutta: the profit of trade they say has fallen, 400 of the Chittagong traders now themselves bring rice to the Maldives and some Parsees having during the last few years set up a shop in those Islands the Menakoy people no longer have the almost monopoly which they once enjoyed, Menakoy Coir also by no means maintains its character in the market,* and the chief cause the merchants say is that the women make it more carelessly than formerly; old husks are mixed with young and they are not thoroughly cleaned; they mean now to attempt a revolution in this.

67. Cowries (the Beebee's monopoly) continually rise in price, and sugar maintains its ground; Menakoy cocoanuts are known and sought after at Calcutta, Maldive and Galle ones being immediately detected and refused if an attempt has been made to mix and pass them all off as Menakoy, they are sent for inland to Burdwan and elsewhere.

68. Vessels should leave Menakoy in $\frac{\text{Karkadom}}{\text{July}}$, visit Maldives, Galle, Bengal, Eastern Coast and return via Galle or Maldives to Menakoy in $\frac{\text{Medom.}}{\text{April.}}$

69. The season opens earlier at Menakoy than on the Coast, and one vessel cannot make the trip to Goa, &c. and Bengal the same year.

70. The smaller vessels generally do the Coast trip while the larger ones go to Bengal, &c.

71. The Menakoy merchants are thoroughly alive to the great loss incurred by them consequent on a rig which prevents their employing less than 17 men in their smallest vessels and 32 in the largest Island "Odies."

* It has fallen from Rs. 16 per maund to Rs. 3, but is now at Rs. 5 again.

72. All the " Odies," " bandodies," " Massboats" and smaller ones are built in Menakoy (the smaller pegged and the two first nailed) partly of cocoanut and partly of woods brought from the main land.

73. Their Massboats sail excellently both before and against the wind, but for the larger vessels they complain that they have no good model, and I know nothing that would tend more to the prosperity of this community of sailors and traders, who already use English instruments, charts and nautical tables than by opening to them a way of awning better built, better rigged vessels : they find it hard work in their tubs of vessels with large crews to hold their own in a trade where they now find many competitors, and are most anxious to avail themselves of any means of placing themselves more on a par with others : whether this would best be done by giving them working models, or by presenting Hussan* Malikan with a small properly built vessel (cutter or schooner) as a lasting and useful memorial of the sense entertained by Government of his loyalty, or in what other way it is unnecessary for me to suggest.

Miscellaneous notes on Menakoy.

Prices on the Island and elsewhere.

74. Sugar.—7 adubas..........Rs. 1.
= $\frac{3}{4}$ its bulk in Bengal rice.
= $\frac{1}{2}$ at the Maldives.
1 pot of it superior = 12 Mass fish } In Maldives.†
inferior = 8 do. }

75. Coir.—4 polies = 1 Mayna of rice }
= about 1 Anna. }
1 maund = Rs. 3 } In Menakoy.
= Rs. 5 in Bengal‡ }

* See remarks on him in the Report on the Magisterial enquiry.

† A good market always to be found, also at Galle and in Malabar, but the latter too small

‡ They formerly got Rs. 16 per maund, the price sunk to Rs. 3 per maund and is now rising again.

76. Cowries.— = its bulk in rice.
= 2 ——— salt.
= 1 maund = Rs. 22 last year at Bengal.

77. Mass.—400 pieces (from 100 fish) = Rs. 8 or 10 at Galle
Meenshakrai = its bulk in Menakoy sugar. } Sold at this rate by the Maldive men.
= 2 ——— Bengal rice. }
6 "Chippies" (slop basins) of Meenshakrai = Rs. $2\frac{1}{4}$ at Pulo Penang.

78. Cocoanuts—purchased by the merchants at the rate of 1 R. for 80. } In Menakoy.
——— 1 Mayna of rice = 5 Cocoanuts. }
——— 1 Anna = ——— }
sold by the merchants to the people at the rate of 50 = 1 R.

Prices.

79. Rice—1 Candy = 7 Rs. at Balasore (with the husk.)
1 Modah ($\frac{1}{12}$ of 1 Candy) = 2 Rs. on the Coast (unhusked.)
1 Mayna = 5 cocoanuts = 1 Anna.
= 1 Mayna of cowries.
= 4 polies of coir.

80. An ordinary boat 20 ft. by 4 may be built of cocoanut wood in a fortnight for Rs. 50.

A mass boat in 4 months for Rs. 200.

Weights and Measures.

81. 1 "polly" (of coir) = 20 Rs. weight 12 mayna = 1 Kotta.
60 pollies = 1 Tholam = 28 Ratels
3 Tholams = 1 Maund 1 ——— = 1 Bengal sher.
$7\frac{1}{2}$ Maunds = 1 Candy ——— = 2 Ratels
——— = 80 Rs. wt.
38 ——— = 1 Mangalore modah.
80 ——— = 1 shak.
$3\frac{3}{4}$ shak = 1 Candy.

300 mayna =
$13\frac{1}{2}$ or 14 shak = 1 Ton.

Wages.

82. *Sailors.*—When serving the Beebee, daily rations of $\frac{1}{2}$ mayna rice, 2 cocoanuts, &c. a present of 7 adubas of sugar, 50 cocoanuts ; 11 maynas of rice are allotted space for such merchandize as he likes to take each way. He and his wife are exempted from poll tax, if (when in the Beebee's service,) they are detained by stress of weather at Cannanore, then they get Rs. 2 a month extra.

Wages.

Sailors—When serving private parties each sailor has Rs. $4\frac{1}{2}$ monthly, rations 3 shak of space. } In Ally Malikan's Barque.

Steersman Rupees $6\frac{1}{2}$, half the space in the vessel appropriated for the use of the crew.* Each sailor has rations, and 1 share (which in practice usually amounts to 1,500 cocoanuts) malmy (or master) 2, Tandayl or Captain 1, and 1 candy of rice on return, malmy 1 shak for taking vessel in and out of lagoon. If the sailor has no capital to trade with, then the owner lades his share of the space for him, and on reaching Menakoy retaining 15 maynas per 1 R. of whatever sum it may have cost, hands over to him the remainder which is usually about $\frac{2}{3}$. If thrifty the sailor can easily bring home rice for the year and some Rupees besides.

84. The duties of the crew are to sail the vessel, and on their return to haul it up, dammer it, twist ropes from materials supplied by the owner and launch it again at the season.

85. *Carpenters.*—A superior workman gets daily a meal, 3 cocoanuts, 2 maynas, $1\frac{1}{4}$ aduba sugar.

An inferior do. 2 cocoanuts, 1 mayna, $\frac{1}{8}$ aduba sugar.

An assistant who bores the holes required in boat building gets $\frac{2}{3}$ of the above.

The meal consists of $\frac{1}{4}$ mayna rice, 1 cocoanut, $\frac{1}{8}$ aduba sugar.

86. *Blacksmiths.*—Are paid at the same rate.

87. The way in which the produce of nuts of the Beebee's plantations is collected is as follows.

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* From 24 to 32 men form a crew.

88. Once a month the Beebee's employees inform the women of the Island before hand of the day which has been appointed for the picking up of the nuts, and on the day a woman or more from every house except those of the Malikans goes at sunrise to a part of the Beebee's plantation.

89. The people are not admitted into these at any other times, but for these occasions they are divided off into portions by the paths which intersect them, in each of these divisions is a rude storehouse.

90. The women usually return every month to hunt for nuts in the same division, and thus at dawn each goes straight to her usual division, collects what nuts she can find at the foot of the trees, and taking them to the storehouse of that division receives 8 cocoanuts for her day's work and a per-centage of 4 (nuts) for every 100 she has collected: the nuts are counted at the store-house by the Beebee's employees with temporary assistants from among the Islanders (who also are paid for their services in nuts), and the woman is then allowed to return homewards with as large a bundle of firewood as she likes to collect and carry, and a basket with her cocoanuts in it and a chit of leaf saying how many she had collected: near the place where all the houses are, the Bee-bee's chief agent sits and examines each of the baskets and chits as they pass to prevent robbery.

91. Of the 8 nuts given to the women as cooly, 3 have the shell broken to prevent their coming into mârket in competition with the Beebee's nuts.

Massfishing.

92. The profits of Massfishing are very uncertain, as they de-pend entirely on the numbers in which the fish themselves arrive in the neighbourhood, and this is very variable. the 14 per cent. of the daily catch which goes to the owner of the boats does not pay them if the numbers caught are small, but it does very hand-somely if they are large.

93. There are in Menakoy 10 Mass-boats, they fish continu-ously for only 6 months in the year, the other months being too stormy, and about 50,000 fish is the average number taken; 100,000 could only be taken in a very fine season; about 25,000

are used in the Island and the remainder are cut up, dried or made into meenshákrai, and exported: the fishes are each cut into 4 pieces, and the bones and any scraps are boiled into a rich soup with more solid balls of the same substance in it, the dried fish is sold in the Maldives, Galle, and Malabar Coast at the rate of from 8 Rs. to 10 Rs. for 400 pieces of 100 fishes: the soup called strangely "Meenshákrai" (fish sugar) is much used in Menakoy and is also sold at Pulo Penang.

Diseases.

94. The most common disease on the Island is what they call "Vathám" (gout or rheumatism ?), as many as 100 have died of this in one year: those attacked by it usually die within a month of the time of the symptoms becoming observable.

95. Cholera was not known here (as in Malabar) more than 30 years ago. There were severe attacks of it 10 years ago, and 5 years ago on which last occasion 370 died of it at the rate of 10 or 15 a day.

96. Small-pox has never been very virulent on the Island: the crews were attacked one year in Bengal and 100 men carried off. The Islanders provide themselves at their own expense with vaccinators from the main land.

97. When Small-pox appears those attacked by it are sent for 40 days to a small islet at the south end of the lagoon, which is thus used as a quarantine station.

98. Leprosy is always in the Island, and those afflicted by it are restricted to a part of the north portion of the Island where they form a small community of their own: they have a small boat and a few cocoanut trees, and their relatives place food daily or weekly within their reach till they die.

99. Hussan Malikan and Ally Malikan, the two chief merchants of Menakoy, usually export 40,000 cocoanuts each annually.

100. Ally Malikan's usual export of coir is above 500 Tholams annually.

101. The usual annual export by the whole of the Islanders, 1,500 Tholams of coir.

102. This has been a pretty steady average for 30 years. Last year 2,000 Tholams were exported, because the previous year hav-

ing been thrown away in rebelling against Government, and the Bengal trade for that season lost; the people were in great distress for food, and the merchants only providing them with rice in exchange for coir, they had to make more of it than usual.

103. Export of cocoanuts has decreased, because 20 years ago proper attention was not paid to planting, and also theft has not been rigorously checked.

104. There is no such thing in Menakoy as entailed (or "Turwad") property.

105. The Islanders state the freight of one candy of rice from Balasore to Menakoy to be about Rs. 7, and that of one maund of cowries from Menakoy to Bengal to be about Rs. 5.

XII. *General Description of the country between Parvatipore and Jeypore.* By Lieut. J. Vertue, *District Engineer.*

The country between these places may be divided into four portions.

1st. From Parvatipore to the commencement of the jungle, a distance of about 4 miles in which the soil is light, gradually becoming mixed with red, and the country well cũltivated.

2nd. The jungle portion, which extends for 37⅓ miles, or to the foot of the reverse slope of the Bijiya Ghaut. The soil in this portion is uniformly red, and where the jungle is cleared, seems productive. The principal villages on the road are Alunmdah, Kattoolapett, Bundagám and Narrainapatnam; the last a large place containing about 1,000 inhabitants. About the first two and last named villages, the jungle is well cleared, and there is a good deal of cultivation, principally dry. These villages, as all indeed on the road, are situated close to the river (Chicacole river) in which there is water the whole year round. This country is considered the most feverish and dangerous on the road, and as little time as possible should be spent in it. The Road or Track, as it

would be more properly called, through it is in some places level and good, and would be easily and cheaply made into a good road, but in very many places it is very stony and rugged and through dense jungles. The track up the Ghaut is exceedingly rocky, steep and bad, and here the road would be very expensive. The river which runs close to Chicacole and falls into the sea at Calingapatam, takes its rise at the head of the Bijiya Ghaut, and is crossed very frequently by the present track. During freshes the depth of the river where it is broad, and its slope moderate, is frequently from 5 to 7 feet, but the river falls rapidly, and consequently causes no great detention to travellers, hence the absolute necessity of bridges is not so obvious as in the upper part of its course, where the bed is considerably narrowed, and very rocky, and where the slopes on either side are so steep as to give the river the appearance of a wide and very deep nullah. Were, however, a good road made, I have not the least doubt, that a vast improvement would be made in the state of the country, for as almost the whole of the traffic, which is at present conveyed by different routes to Chopatombo near Jeypore en route to Nagpore, would be attracted to this line, which is considerably shorter than any other, the natural consequence would be that the villages would become larger, the country more thickly populated, and the jungle more cleared, the latter tending much to destroy the unhealthiness of the climate. I should mention that the surface soil is generally extremely hard, and well suited for road making, various kinds of rock are found on the Ghaut, the majority being soft sand stones, more or less intermixed with other substances. Iron is also found on the Ghaut, in some degree of richness at the top, the quantity and richness both diminishing as we descend, and disappearing almost altogether soon after reaching the foot of the Ghaut, on the Parvatipore side. The stone called soap-stone or powder-stone, a stone of extreme softness and friability, is also found in considerable quantity. I did not see much granite on the Ghaut, but from the peculiar shape of the peaks of some of the mountains which form the gorge, I conclude that they are to a considerable extent composed of that species of rock.

3rd. The 3rd portion extends from the foot of reverse slope of the Ghaut for about 26½ miles. This is an elevated Plateau averaging about 2,000 feet above the sea, and of an extremely undulating nature, becoming more so as we proceed until at length the country is a perfect chaos of uplands and valleys. The soil of this country is uniformly red often mixed with gravel, and indurated to such a degree as strongly to resemble laterite, and such being the case, a more favorable soil for road making could not be desired. The nature of the country too offers every facility for making a level road, for this could easily be done by making the line a little longer than the present track, and taking the greatest advantage of the undulations of the ground. The present track runs along the gently sloping shoulder of a hill, then descends and crosses a valley, ascends another gentle slope and so on. Generally speaking, the slopes on the present track are so gradual and easy, that perhaps it would scarcely be worth while to deviate from it. The country from the foot of the Ghaut for 15 miles is perfectly bare of wood, and in most places abounds with iron, with which indeed from the 44th to the 47th miles the soil is literally impregnated. There is no iron stone quarry on the road, but there are several places, and in particular the place I have just mentioned where doubtless a quarry might be opened with much advantage. The ore is generally either red hematite or a red earthy oxide of iron. Either of these varieties when pure yield about 70 per cent. of iron, but allowing for existing impurities, it is not probable that this would yield more than 45 to 50 per cent. which is, however, a large per centage, and equal to that derived from the clay iron stones of Great Britain. I could see no trace of lime-stone, and have been told that such is not here met with. The rocks and stones most commonly encountered are of a compound and mixed nature, and generally very soft and friable. Their composition appears to be generally a considerable quantity of sandstone with iron spots intermixed with felspar and mica, the two latter, and particularly the former, generally much decomposed. Granitic rocks seem to be almost entirely absent, but the ground is in several places pretty thickly strewed with compact quartz, or quartzite. Through the centre of every valley is a nullah, often

very wide and deep, showing that a large body of water must pass through it during the rainy season, and as the Nullah of the main valley receives supplies of water from the Nullahs of the numerous smaller transverse valleys, the quantity of water sometimes in them must be great, although the great fall admits of its being carried quickly off. The soil of the valleys and of the bottoms of the Nullahs is largely intermixed with black soil and a yellow ochreish earth, giving to the whole a greyish black colour. In some Nullahs this yellowish earth is largely predominant, and this I have observed to be an indication of the presence of iron in the vicinity. The cultivation on the uplands is of course entirely dry, as the slope is so great from the undulating nature of the country, that the water must immediately run off, and the air is so very dry, and the evaporation so great, that unless on a very vast scale, it would be unprofitable to make Tanks. In the valleys and Nullah beds, however, is cultivated paddy and wheat, and every available square foot of ground is used by the people for this cultivation.

2. The climate of this elevated region is extremely dry, and evaporation is consequently extremely rapid. Water in a goglet remains all day as though cooled with saltpetre, and after standing all night it is in the morning extremely cold. The mean temperature appears to be from 10 to 15 degrees lower than that of the low country, or of the country in the vicinity of Jeypore. In the morning about sun rise in the beginning of April the thermometer is as low as 60° and the maximum temperature is about 90°, this probably a good deal raised by the hot winds, which blow with considerable intensity for from 4 to 5 hours during the day.

3. The country for 15 miles is entirely bare of wood, and even the hills have nothing on them, but a very low thin jungle. Their tops are almost universally of the form known as dome shaped, another proof of the absence of granitic rocks which when present in hills in any quantities, give to their summits a sharp serrated form. The whole country has an appearance similar to what one can conceive caused by the wave of an earthquake having at some probably very remote period passed over it.

4. The air is, as I have said, extremely dry, and from the exceedingly undulating nature of the country, rain water must run off very quickly : all this, added to the entire absence of jungle, must render this tract of country entirely free from Malaria, and

from the fever which it breeds, and indeed I myself should consider the climate extremely healthy and well suited to Europeans. The soil is well adapted to the growth of wheat, and I am convinced that potatoes and other European vegetables might be well and easily raised, considering the very high price paid for potatoes in this part of the Presidency, and the extreme uncertainty of the supply. I am sure that were it found that potatoes could here be well reared, their cultivation would be most remunerative, and would be a great boon to the European inhabitants of the two Northern Districts, both as regards constancy of supply, and lowness of price. At all events the experiment is well worth a trial. It would also be easy to extend wet cultivation, and ensure a large supply of water during the dry weather, by damming up one or more of the valleys on a high level, and leading the water to those on a low. Stone for this purpose can be procured in any quantity and easily, and I doubt not that lime-stone would be found were an active search made for it. As regards trees, the country seems almost entirely bare of them; but the soil is peculiarly adapted to the growth of the Mangoe, and that fine tree the Jack. There are only 3 small Ghauts encountered previous to arrival at the very steep Ghaut, which separates this elevated country from that in the vicinity of Jeypore, and none of these present any great difficulties.

5. There are a number of small villages on the line, and 2 of large size, viz. Mirtchmala, and Madheopotto. The former contains about 70 and the latter about 100 houses, and in them all ordinary supplies and coolies can be procured.

6. Altogether I consider this an interesting country and one well worthy attention. There is a very great difference between its climate and that of the low country; I am quite convinced that it is perfectly healthy, and think that a change to it from the low country would be most beneficial to European constitutions. Until, however, a road is made, and the difficulty of procuring supplies diminished, the difficulties to be encountered are far too great to tempt any one, not obliged to do so, to visit the country.

4th. 1. The 4th and last portion of country, to which I have alluded, is the country in the vicinity of the town of Jeypore lying about 1,200 feet above the sea, and separated from it by a tremendously steep ghaut about 700 feet in height.

2. The soil of this country seems, near Jeypore, to be principally black, although I am told that red soil is as often found as black. It is very productive, and where irrigated produces very fine crops. The rains commence in the end of May, or beginning of June, and last till the middle of October. They are not throughout that time continuous, there being from time to time intervals of fair weather of a week or ten days' duration. The heaviest rain occurs in July, August and September.

3. Jeypore itself is an extremely hot place, the thermometer in the beginning of April standing in a Tent (Double Fly) as high as 108, while in May I understand that the heat is terrific. The air is more humid, and the climate much less healthy than that of the elevated country just described. From sunrise to sunset the haze, caused by the heat, is so dense, that large objects a mile distant can only be distinguished with great difficulty. In the vicinity of the town, is produced a large quantity of paddy and vegetables, irrigated from a large tank of 1¼ mile in length, and ½ mile in width, said to be very deep, and never known to be dry. In the vicinity of the town are magnificent topes of mangoe and jack trees, which seem here to thrive extremely well. On all sides but one the town is surrounded by low jungle, in which grows in the most luxuriant profusion that magnificent tree, the Dammer, which, however, from the thickness of the jungle, and its having consequently no room to grow, never attains to the dignity of more than a large shrub. The inhabitants are evidently unaware of the great value, not so much of the timber, for until a road be made it cannot be transported to the low country as of the pitch which is derived from the tree from a large sized tree in quantity about 3 maunds per annum worth 3 or 4 Rs. By thinning the jungle, the trees would soon grow up, a result which cannot otherwise be attained.

4. The town of Jeypore contains, I should imagine, about 7,000 inhabitants, and is a most wretched place, there being scarcely half a dozen tiled houses, and these of the most inferior description. The remainder of the houses are mere huts, far from being inhabited by artizans of all kinds as stated in the road book, compiled by the Deputy Quarter Master General, there is not an artizan in the place, save one carpenter, and he a Teloogoo man, not a native of the country. The fact is that the wants of the

inhabitants are so few, and their requirements so easily satisfied that every man is his own artizan. Every man carries a small sharp hatchet for cutting and felling timber, and when he requires any wood for building or other purposes he takes his pair of buffaloes to the jungle, cuts what he requires, has it dragged home, and then fashions it with his hatchet. The bazar is not well supplied, and many articles commonly met with in the small village bazars of the low country cannot here be procured.

5. Cattle are plentiful, and though small, good, but sheep and goats are rather scarce.

6. A pair of good buffaloes can be procured for about 25 Rupees; a pair of bullocks for 10; and sheep and goats for about 1 Rupee a piece.

7. Rice sells at about 12 Rupees per Garce; wheat 25 seers per Rupee, salt 1 anna per ℔, and iron 1 Rupee per maund.

8. In Jeypore, however, not a single article can a stranger procure, unless the Rajah gives permission to the banians to supply him. The country seems to be sadly mismanaged and misgoverned. The Revenue is about a lack of rupees, about one-third of what might easily be derived from it, were it in better hands. It is principally derived from the land tax, which is fixed at 1 Rupee per pair of bullocks, so that a man, so long as he pays at this rate, may cultivate as much land as he pleases.

9. The Rajah is an old man, quite silly and so totally deaf, that he can only be communicated with by means of signs. He is surrounded by a set of scoundrels, who plunder him right and left, and who have of course grown rich in his service. So destitute is the poor old man, that his head man, or Manager, who is a most consummate scoundrel, doles out to him one or two Rupees a day, to procure for him the common necessaries of life.

10. From Jeypore to Nagpore the distance is about 300 miles, and from the information I received, I conceive that a road could be very easily made as no Ghauts are encountered, and nothing need be done but clear the jungle, which extends almost the whole way between the places. The population is said to be scanty, and water in one or two places not easily procurable.

11. There is also a road from Jeypore to Budrachellum on the Godavery, but said to be very difficult, to cross many Ghauts, and to be almost entirely through jungle.

12. There are several roads through the Jeypore country to Nagpore, but the road in question is considerably the shortest, and as I have said, were a road *made*, as almost a matter of course, all the traffic would be attracted to it. The amount of traffic is not very easily estimated. But I judge that annually from 60,000 to 70,000 Bullocks pass and repass from Nagpore to the Sea Coast, of which about 12,000 travel by the route, I have been describing.

13. On their downward journey they carry various articles such as Palagoonda, Sealing-wax, Bee's-wax, Turmeric, Oil-seeds of various kinds, Wheat, Rice, the various kinds of grain, Cotton, Dammer, Soapnut, Deer and Buffaloe horns, Skins, and Iron.

14. The articles carried back are principally salt, tobacco, salt-fish, opium and cloths.

15. In my notes I find a Memo. of the places nearest the low country, where Iron-stone is found in large quantity.

1st. At Dzorapukonda, a village 20 miles from Narrainapatam, and situated in the Kumbariputtee Mootah. At this place there is a quarry.

2nd. From Loharguda to Dzorapukondah, 12 miles, plenty iron-stone is found, but there are no quarries worked.

3rd. In the Borigee Mootah, at the village of Bhittarilotsa, 12 miles, from Narrainapatam there is a good quarry.

4th In the Poimals Mootah, at the village of Gummidikondah, 15 miles from Narrainapatam there is a good quarry.

5th. At Riga, 10 miles from Narrainapatam, there is abundance of good iron-stone.

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5. The last subject to which I shall allude is the importance of the road, both in a Military and Commercial point of view. With regard to the first, it would effect a saving of about 300 miles on the present route to Nagpore via Secunderabad or in time of about 5 weeks, a serious consideration when time is of importance.

6. In a Commercial point of view the advantages derived would at least be equally great. The traffic to Nagpore is, I have shown, even now very considerable, and there cannot be a doubt that the making of a road would at once cause an immense increase in the trade of Salt, and a considerable decrease in its price, which even at Jeypore is upwards of double that at which it can be procured in the low country. The Jeypore country too is capable of very

great improvement, and it might be made to produce large quantities of rice, wheat, potatoes and other European vegetables, fruits of various kinds, &c., while the trade in iron and valuable timber would also be very largely extended.

7. There can be no doubt that the jungle country is very feverish and unhealthy, and I should imagine that the town of Jeypore and vicinity is in a less degree of the same character. The rainy season is very dangerous and unhealthy; rainy weather, when accompanied by cold more so still, while the cold weather of December and January is almost as unhealthy as the rainy season; some, indeed, consider it more so. The hot weather is the only season in which the jungles can be entered with comparative safety, but even then the chance of escaping fever is very slight, even to Europeans, while Natives are almost certain to be attacked. My own experience amply confirms this, as I myself did not escape, and of the party which accompanied me, every one, without a single exception, was attacked, and two have already died. Malaria is of course the principal cause of this, but there are several others which exercise an important influence, and among these are the fatigue and exposure, and want of good food, the latter, I believe, exercising a powerful influence. A large party going into this country with the intention of remaining some time, should take large supplies and should be accompanied by an Apothecary or other Medical attendant.

8. Camels, or, still better, elephants, are most useful, as they save a number of coolies, who can only in most places be procured with extreme difficulty, and who are constantly running away, and causing great delay and loss of time.

9. I should mention that the Brinjaries do not travel to Nagpore through Jeypore, but strike off the road at Madheopotto and pass 10 miles to the right of Jeypore. The distance to Nagpore by these routes is about the same, while the respective distances by them to Jeypore from Madheopotto are 7 and 26 miles. I examined the latter route on my return, and think it would be the more expensive of the two, while it would not pass through Jeypore, which is of course a desideratum. The only reason for preferring it to the other is I conceive occasioned by the difficulty of passing over the very steep Ghaut, which separates the elevated plateau from the plain of Jeypore.

LIST OF TREES FOUND IN THE JUNGLES OF THE JEYPORE COUNTRY.

Names of Trees. Telugu.	English.	Latin.	Where and whether plenty or otherwise.	Remarks.
విరుగుడు Veroogoodoo....	....	Dalbergia Sisu........	Plenty, N.E. Almundah	Timber very good, strong, and durable; used for building purposes and fine work, such as Boxes, Inkstands, small Desks, &c.
పెనువేప Penuvapa.....	Persian lilac or Bead tree..............	....	Not plentiful.........	For building purposes, seeds for oil, which when applied externally is a cure for itch.
వేప Vapa..........	Neem	....		
టేకు Teak.........	....	....	Do.	For every purpose. The Teak tree is said to be found, but I myself did not see any specimen.
తుమ్మిక Toommeka.....	Ebony..............	Diospyros glutinosa...	Plenty..............	For the same purposes as Veroogoodoo, but work made of it looks finer. The berries of this tree are eaten. The fruit is like a Russet apple, pulpy, of a rusty yellow colour, and covered with farnia; on being punctured, it gives out a juice of peculiar astringency, sometimes used to staunch fresh wounds. The juice or fruit pounded is used as glue.

LIST OF TREES—(*Continued.*)

Names of Trees.			Where and whether plenty or otherwise.	Remarks.
Telugu.	English.	Latin.		
కుంబ Kumbā........	....	....	In Almundah Talook...	For building purposes and other little works, such as Native Slippers, &c. work looks very fine and smooth.
బిల్ల Billa.........	Satin wood	Saietania Chloroxylon.	Do. do.	For roofing purposes and posts &c.
గన్నేరు Gunnāroo......	....	Plumieria alba........	Do. do.	Do. do. and do. Flowers smell sweet and are used for worshiping purposes. This tree has a beautiful and most fragrant flower, fine petated white without, and yellow within.
మద్ది Muddy........	Three leaved Caper tree.	Pentaptera Arjuna....	Do. do.	For roofing purposes (seldom) and posts &c.
వేరుమద్ది Varoo Muddy ..	....	....	Do. do.	Do. do. and do. The powder of the bark or checka (well dried and pounded) will heal ulcers.
ఇప్ప Ippa..........	....	Bassia latifolia........	Plenty	The flowers are the berries, and when dried, resemble a dried grape in taste. By fermentation and distillation they yield a strong spirit. The fruit yields an oil, which is used instead of melted butter, and has medicinal properties. The bark is used in obtaining a brown color, and the wood is durable and compact.

గుగ్గిలం Googgilum	Dammer tree.........	Gum Odellum	Plenty in the neighbourhood of Jeypore and in Pullapoosaka north of Parvatipoor.	For all building purposes. The tree itself gives rum which after sufficiently dried is collected by Hill or Konda people and sold to the local Merchants, at from 2 to 4 annas per basketful (about a Maund.) There is a large and very profitable trade in it.
వెదురు Vadooroo.......	Bamboo...............	....	Plenty on this side (Narrainpatam) and from thence towards Jeypore, neither plenty, nor good, nor strong.	
కోలకఱ్ర Kolakurra.....	Jungle wood..........	....	Not plentiful.	Used merely for Rafters, posts &c.
తడకఱ్ర Thadakurra....	....	....	Plenty	Useful for Cots, small Beams, Rafters, Posts, Door frames, &c., &c. The leaves of this tree are used for platters. The wood is like fir and makes strong bows.
నేరేడు Naradoo.......	Indian Plum or Jambolanum............	Myrtus Cyminum.....	Do.	For furniture and building purposes.
చింత Chinta.........	Tamarind.............	....	Do.	Gives good shade. There is a great demand for Tamarind fruit, which sells at $1\frac{1}{2}$ or 2 annas per maund, Natives will not use its beams, &c. for a house, although they are very strong.

LIST OF TREES—*(Continued.)*

Names of Trees.			Where and whether plenty or otherwise.	Remarks.
Telugu.	English.	Latin.		
చంద్ర Chundra	....	Mimosa Catechu......	Not Plentiful.........	It is similar to the Toommechava.
మామిడి Mamedy..	Mangoe.	....	Plenty..............	Well known tree.
పనస Panasa........	Jack fruit tree........	....	Do. this side (Narrainpatam).........	The fruit of one tree will sell for about 4 Rupees per year. Good beams for door planks.
తెల్లతుమ్మ Thella Toomma.	....	Mimosa Arabica.......	Not plentiful........	For ploughs.
ఉశిరిక Voosereka......	Gooseberry..........	Emblic Myrobalan... .	Plenty..............	Fruit used for pickles, seeds used for chatny and in medicine.
యేకిస Yakesa........	Vengay.............	....	Not plentiful........	For country bandy work, it is nearly as good as Teak, a strong astringent.
కరక Karaka..	Gall-nut tree.........	Yellow Myrobalan.....	Plenty......	Fruit used in medicine and produces a yellow dye used for dyeing the trowsers, &c. of Sepoys and also used like galls. Wood for posts but seldom.

అంకుడు Unkoodoo..			Do.	Roots used for pains or belly-aches. Flowers smell sweet.
అడ్డ Udda..			Do.	Leaves used for making plates.
మోదుగ Modooga		Butea Frondosa	Do.	Do. do. the leaves are peculiarly bright here, and the flowers of a brilliant red, but proverbially scentless. Platters are made of the leaves. The thorny species is used as a remedy for worms in the belly.
జాభరా Jahbharah..			Do.	Seeds for dyeing clothes, which Natives very frequently use.
మర్రి Murry	Banian tree..		Not plentiful.	Gives good shade, the drops (or Voodaloo) from the branches are used for palankeen and tent poles, leaves used by Natives for dining plates.
జువ్వి Joovy			Do.	Gives good shade, leaves do. Beams are made of some well grown trees.
రావి Rahvy			Do.	Do. do. do.
సంపెంగ Sumpenga.			On the Ghauts	Gives good shade which is much cooler than that of the Banian tree. Wood used for building and furniture purposes work it appears, resembles that made of satin wood.

REPORT ON THE JEYPORE PASSES.

Description of the route from Tahtaparty to Jeypore.

Tahtaparty to foot of the Ghaut 1½ Miles.

1. Tahtaparty, 5 miles from Madugole, and 44½ miles from Vizagapatam, is situated 1½ miles from the foot of the Ghaut at an elevation of about 250 feet above the sea level. The ground about it is much broken up by ravines, the soil being reddish close to the hills, from which as we recede, it becomes more and more mixed with black soil, limestone in minute nodules being extensively strewed over the surface. There is a road made, so far as earthwork is concerned from Tahtaparty to the foot of the Ghaut, and it is still, though untouched for several years, in very fair condition.

Foot of Ghaut to top of do. 12 Miles.

2. The Ghaut may be described in a few words. It is a very steep and exceedingly stony and rocky ascent, which to make into a decent road would be costly, while the maintenance would be no less so. The ascent is almost continuous, there being but few breaks, and these short. The elevation of the top is nearly 3,200 feet above the sea level, and 2,970 above the foot, and as the distance following the road, is exactly 12 miles, the slope is, 1 in 22 nearly—this, inclusive of level, or comparatively level surfaces, of which there is probably about 3 miles, with an average slope of 1 in 40. This will leave 9 miles of Ghaut with an average slope of 1 in 19 nearly, very steep indeed, and, being almost throughout overlaid with bowlders, rock or stones, both large and small, the road is exceedingly difficult, whether for horsemen or pedestrians, for bullocks laden or unladen. The first half of the ascent was some years ago cleared of jungle for a width of some yards on each side the road, but this has again sprung up as thick as ever, and in many places the branches and foliage overhang the path, rendering the passage difficult. The jungle on both sides of the road is in general very thick, but trees of any size seem uncommon. The rocks met with are all unstratified, and seem to be principally gneiss and traps, sandstone and conglomerate rocks being few, and no traces of iron.

Top of Ghaut to Minoogooloor 2 Miles.

3. From the top of the Ghaut to Minoogooloor, a descent of nearly 500 feet, the road is stony and steep, but well shaded. Minoo-

gooloor is a small village situated at the base of one of the ranges of high hills which abut on the main chain and run in a North West direction, and here enclose a very narrow valley, about a mile in width, through the middle of which flows a stream. These hills, which recede in height as we go inland, are here covered with dense jungle, and rise 1,500—2,000 feet above the valley, their elevation above the sea being about 4,300 feet.

Minoogooloor to Hookumpett 8 miles.

4. The commencement of this portion of the route is through a long narrow valley, the soil of which is black, and covered with a long and very coarse grass, more resembling one of the rush tribe than the grassy, very useful and valuable as a thatch, but utterly useless as fodder seeing that no description of animal will touch it. The scenery of this valley is very beautiful, hills on each side covered with jungle, and at bottom, with large trees rising 1,500 feet above it, while through its centre flows a fine stream of water. The road crosses 2 or 3 small nullahs, and is in some places rugged and a little stony, but practicable for cart traffic. Emerging from this valley the road enters a much more open, and very undulating country, bounded by small hills, which gradually become bare of jungle, and diminish in height the farther we proceed into the interior. Villages are few and far between, and the country has a bleak desolate appearance, by no means relieved by the cold greyish black soil which supports an abundant crop of the long grass before mentioned. It is no doubt however capable of better things, and would I think, be well suited to the growth of cotton, unless, indeed the elevation of the country be obnoxious to the growth of that useful plant. The late season having been one of the driest on record, we were of course prepared to find water unusually scarce, but throughout this region, even in the hottest weather, there is always more or less water to be found in the small stream, which flows through the bottom of every valley, and of which the high, precipitons banks afford ample evidence of the torrent of water, which must at times swell it. On each side of the centre of each valley, paddy might be cultivated for a considerable distance, but the population is so scanty, and their wants so easily satisfied, that they are satisfied to cultivate dry grain, or

at best no more paddy than is sufficient for their own consumption. The road passes through the village of Hookumpett, which seems to contain 40 to 50 houses, while to the south east, distant about ¼ mile is a river about 20 yards wide, with very steep banks 15 feet high, and a sandy and gravelly bed.

Hookumpett to Aurāda 20 miles.

5. After leaving Hookumpett the road passes over a bleak, stony, uncultivated country, as before very undulating, the valley is of black soil, and bearing nothing but the coarse grass before mentioned, which was in many places on fire, and burning with surprising rapidity and a loud crackling noise. In the first 3 miles, several small nullahs were crossed, also the river last mentioned, which is like all the rivers of the plateau, extremely circuitous in course, being compelled, as it were to follow the course of the valleys. The water in this river we observed to be much discoloured, as though containing much clayey matter, a fact difficult to account for, as the water in similar streams I had always observed to be beautifully clear. The most probable explanation is that, the water running from the paddy and other cultivated fields, then in a slushy and muddy state, occasioned the discoloration. The road now lay through a long and very narrow valley, bounded by high hills covered with jungle. This valley is about 5 miles in length, and does not average more than half a mile in width, the soil still principally black, and with little cultivation. On the west side of the valley we observed two very narrow valleys, very similar to that through which we were passing, bounded by very high hills, covered with dense jungle, and running far into the interior. The road through this valley crosses several nullahs, and is partly free of jungle, which, is never very thick. Towards the head of the valley we crossed a tremendously steep and difficult nullah, through which a considerable stream, along the top of the east steep bank of which the road which is very rugged and stony, ran. The ground is now seamed with ravines and nullahs, and is consequently a succession of steep ascents, and descents, and difficult, rugged, and stony. The head of the valley is shut in to all appearance by a magnificent hill, upwards of 4,000 feet above the sea, and quite bare of jungle for some hundred feet from the top, to the south west of

which is another very similar in appearance, and of about the same height. Passing on the east side of this hill, the road turns slightly to the east and enters a more open country, bounded by low, dome-shaped hills, and still little cultivated, although the soil seems good, and there are great facilities for irrigation. The road, though still a little stony, is over tolerably level ground and could be easily made. At about 12 miles from Hookumpett the aspect of the country changes—the soil becomes more decidedly red—cultivation is more discernible, and the mango and jack trees are again seen, affording a pleasant relief to the eye, wearied with the barren and inhospitable looking appearance of much of the country through which we had hitherto passed. Three miles farther on, the country still much as just described, but improving in appearance, and in increase of population and cultivation, we reached the large and picturesquely situated village of Wandragedda, the principal village of a Talook belonging to the Jeypore Rajah whose country we had now entered, and passed through, being under the Zemindar of Madugole. The village is beautifully situated at the re-entering angle (very acute) of two steep hills, covered with jungle and small trees, down the gully formed by which rushes a copious stream of beautiful water, which flows to the west and irrigates the valley, at the head of which is situated Wandragedda, and which opening out as the stream is descended presents a fine expanse of rich land under wet cultivation. The village contains some 60 houses at the foot of, and on the slope of the hills, and altogether presented a much more comfortable and thriving appearance than any we had yet seen. Leaving Wandragedda we passed through a magnificent tope of mango and tamarind trees, and after following for a quarter of a mile the margin of the valley, which is transversal, we turned to the east, and after half a mile over a rather stony road, skirted by thin jungle, entered a perfectly open country, soil red, and in many places strongly resembling laterite, but with little cultivation, save about villages, small and unimportant, with which the country is here and there dotted. Half a mile farther we crossed a nullah and the road now very good, as much farther in advance, we reached the summit of a rising ground, from which we had a view of a very extensive and un-

dulating plain, bare, and bounded by low hills, and over which villages, generally occupying the summits of eminences, are sparely scattered. Four miles farther on, crossing several nullahs, which supply water to considerable breadths of wet cultivation, we reached the village of Aurada, occupying the summit of an eminence.

Aurada to Soogoor, 10 miles.

6. From Aurada the road lay for two miles through a narrow valley bounded by low hills covered with thin jungle and towards the end of which, I observed iron stone in considerable abundance, and tolerable richness—this being the only place between Tahtaparty and Jeypore where it is found of sufficient importance to admit of record. In the above distance we crossed several small Nullahs, and, at about the centre of it, a tolerably sized river, 20 yards wide, with very high steep banks, and a good stream of water, running to the West. The road, now stony and rugged, passes through a narrow defile, half a mile in length, between two hills covered with jungle, and then enters a perfectly open, and very undulating country, with not a single tree, although covered with low date bushes. The soil is red, and the Nullahs or concavities of valleys of which we crossed many, are well cultivated with paddy—10 miles from Aurada, we reached the village of Soogoor, containing about 60 houses, and occupying the summit of an eminence, while situate a few hundred yards to the South West and occupying another, is another village, which in fact belongs to the former. The view from the village is very fine, a fine undulating plain, quite bare, bounded by low hills stretching almost as far as the eye can reach, split up into a multitude of subordinate longitudinal and transversal valleys well cultivated with paddy, while to the North East and far in the distance appeared a lofty range of hills, possibly that branch of the main chain which running off N. N. W. is crossed by the Bijya Ghaut. The soil is now, and indeed from Wandragedda as far as what is called the Pedda Ghaut, red and gravelly, admirably adapted for road making, and generally requiring nothing more than trenching.

Soogoor to Dadee, 13 miles.

7. The road between these places passes over a country much as last described, the soil being red and gravelly, and bearing abundance of low date

bushes, but no trees, several nullahs watering a good deal of paddy ground being crossed, and several villages of some size passed close to our place of encampment at Dadee, we crossed a very steep wide nullah, with a small stream of water through it, and with much in its banks and bottom of that peculiar yellow ochreish earth, which is so often an indication of the proximity of iron. Some years ago there was a village at this place, but it has been abandoned on account of the ravages of tigers, which seem to be much on the increase.

Dadee to Jeypore, 13 miles.

8. From Dadee the top of the Ghaut, distance 4 miles, the road is a little stony and rugged, lying between low hills covered with jungle, the Ghaut is about 700 feet in height, and 2½ miles in length, the first 1½ mile exceedingly rocky or stony and difficult, though not very steep. It is well shaded, the jungle being dense on both sides, and containing here and there some fine trees. The last mile of the descent is still through jungle, and a little rugged, but pretty free from rock or stones, and at its termination is reached a fine river about 50 yards wide, and 7—10 feet deep, which we crossed on a rude ferry boat. The river here widens out considerably, and seems indeed to have formed a deep pool, but a considerable volume of water was flowing through it when we crossed, while during the monsoon it must carry off a great body of water. From the river to Jeypore 6 miles, the country is better peopled and well cultivated, the road some times rough and stony, but generally pretty good, runs not far from the low range of hills that on the S. and S. E. bound the great plain of Jeypore.

Comparison of the Madugole and Parvatipore Routes.

1. Having now seen both routes, I have no hesitation in saying that I consider that by Parvatipore infinitely the superior of the two, and that for many reasons.

2. In the first place the highest elevation to be crossed is in favour of the latter route by upwards of 400 feet, a serious consideration; particularly when it is remembered that not only has that elevation to be ascended, but to be descended, so that in the

mere matter of making a road, there is upwards of 800 feet more of Ghaut by the Madugole, while for those journeying backwards and forwards there is in ascent and descent combined a difference of 1,600 feet, for it must be remembered that, particularly to beasts of burden, a steep descent is perhaps even more trying than an ascent.

Road over Madugole Ghaut more expensive in formation and in maintenance.

3. The Madugole Ghaut has a steep ascent of 2,970 feet in 12 miles, or a slope of 1 in $22\frac{1}{2}$ nearly, while the Bijya Ghaut on the Parvatipore route though much steeper is very much shorter, and has a much smaller elevation, there being a rise of 1,228 feet in a distance of 4 miles, or a slope of a little less than 1 in 16. I should however mention that the latter Ghaut is considered to commence nearly 2 miles nearer Parvatipore than I have put it down, and if this be considered, the Bijya Ghaut will be 5-8 miles long with an elevation of 1,451 feet, which gives a slope of 1 in 21. The length and elevation of a Ghaut are important considerations in regard as whether they can be traversed during a day. This the Madugole Ghaut could not be by loaded animals, at least not without great difficulty, and, not to speak of the danger from tigers and wild animals, which infest these Ghauts, the feverish character of the atmosphere, that at night surrounds them, renders a night encampment on them in the highest degree objectionable.

A route then with a Ghaut easily crossed in one day is very much to be preferred to one that cannot. I may mention that our party proceeding with as much expedition as possible were 6 hours in ascending the Madugole Ghaut. This latter is too, almost throughout, rocky, or covered with loose stones, the latter even more objectionable than rock, while on the Bijya Ghaut comparatively little of the road is rocky and scarcely any part of it is covered with loose stones. The latter then would be less expensive to make and maintain, than the former, and it possesses one great advantage that the other has not viz. water is plentiful throughout from the bottom to the top.

Distance of Jeypore from the nearest Seaport, the same by both routes.

4. The nearest Seaport to Jeypore by the Madugole route is Vizagapatam and that by Parvatipore, Calingapatam, and these dis-

tances are within a mile the same, each being about 131 miles and in this respect then neither has any advantage, but we must remember that from the foot of the Madugole Ghaut to Jeypore is nearly 80 miles, while from the commencement of the jungle region to the same place by the other route is only 64 miles.

Parvatipore route more advantageously situated than the other and much more used.

5. The route by Parvatipore is, I think, the more advantageously situated of the two, being as it were between the Ganjam and Vizagapatam districts, which are the literal districts holding most communication with Jeypore, and the Nagpore country. The traffic is at present almost entirely carried on by the Brinjarries, who bring down various sorts of grain and gram, hides, horns, bees' wax and a multitude of other things. These people have no objection to the low country, which they would if possible avoid visiting, as its climate and other circumstances are uncongenial to themselves, and to their bullocks, and I doubt not that they would be glad to leave their loads at the foot of the Ghaut, and receive there, supplies of the articles which they carry back, of which salt is by far the most important. Were this done and a depôt established at Narrainpatnum which is a very large village about 23 miles from Parvatipore, and 44 from Jeypore, I think that a great impetus would be given to the increase of traffic, which would thus be so enormously facilitated. I make this suggestion, because instead of proceeding with the whole project, as submitted by me, it would then only be necessary to make a cart road from Parvatipore to Narrainpatnum, which at a rough calculation, might be done for 1,000 Rupees a mile. I am certain that the execution of merely this small portion of the project would greatly increase and facilitate traffic, would much tend to the developement of the resources of the country, besides increasing the amount of population and cultivation but at present very small, and very much increase the present importance of the line. It must not for a moment be imagined that from this, I do not recommend the completion of the line to Jeypore, and even to Nagpore; on the contrary, from what I have seen and heard during my recent visit to the country, I am more than ever convinced of its immense importance, both politically and commercially, but I

have thought that disinclined as is the Government of India, during the continuance of the present financial embarrassment, to recommend the commencement of the scheme as a whole, they may be disposed next year to countenance the undertaking of the portion of the scheme mentioned above, which under any circumstances must be the portion of the line first commenced and completed.

The present amount of traffic by the Parvatipore route many times exceeds that by the others—this owing to the former being much easier than the latter, and every one with whom I have conversed on the subject, is of opinion that were a road made by Parvatipore, all other routes would be almost entirely abandoned. The country through which it passes too is in almost every respect superior to that by the Madugole route, whether in size of villages, extent of population, capabilities of improvement, or resources. As I have just mentioned, the Parvatipore line is very much more used than the other, and this alone, in the absence of other circumstances, would lead us to conclude it to be a much easier and more improbable route.

Objection raised to the Parvatipore route.

6. The only objection I have ever heard raised to the Parvatipore route, by those acquainted with both, is the number of times must be crossed the river, which, rising in the Bijya Ghaut, enters the sea at Chicacole, and even this they hold to be small and more than counterbalanced by the numerous other advantages offere d. To this objection however, even taken by itself I attach little weight, for in the first place the crossing, where objectionable, might without doubt often be avoided by making the road a little longer, and even where this cannot be done, a bridge (if necessary) can easily be erected, timber being every where plentiful, and foundation soil excellent. It is only however, after a heavy fall of rain, of one or more days duration, that the river would not be easily passable, as between Parvatipore and the foot of the Ghaut, in which distance it is crossed 24 times, the river is generally wide, and with low banks, nor either from reports, nor from appearances, do I gather that the volume of water is ever for more than a very short time, and that occurring but seldom during the year, sufficient to cause stoppage

to traffic. I consider then the quasi obstacles offered by the river to be of little consequence, and to be almost counterbalanced by the advantage present and prospective accruing from the possession along the greater part of the route of a fine river, affording *at all seasons* an abundant supply of water.

In conclusion I will mention that I have now travelled by three routes, from Jeypore to Madheoputtee, a large village, on the Parvatipore side of that route. Two of these, in length respectively 10 and 26 miles are mentioned in my account of my first expedition to Jeypore. The remaining route I traversed on my recent tour, and consider it preferable to either of the others, as it is about the same length as the shorter of the two first mentioned, and very much easier, both throughout and as regards the slope of the steep descent, from the plateau to Jeypore. The above of course only tends to confirm the prepossession I have in favor of the Parvatipore route.

Miscellaneous Observations.

Configuration of the Plateau.

1. The Plateau, or elevated region between the District Vizagapatam and the plain country of Jeypore is enclosed on the East by a chain of hills stretching N. W. attaining their greatest elevation in the vicinity of Madugole, and gradually becoming lower as they approach the Northern extremity of the District. From this chain branches run N. and N. N. E. containing some hills said to be even higher than any in the main chain, but the general run of the latter is as before mentioned. There are several passes over this chain into Jeypore, the principal being those already mentioned, others less used being by Pachapenta and Saloor. From the summits of these passes to the level of the Plateau are slopes of on an average 350 feet in perpendicular height, and little less steep than the opposite ascents, which average about 1 in 20. The Plateau has a tolerably gentle fall to the Westward, and is terminated abruptly by a range of steep hills which sever it from the plain country of Jeypore, and through which to the same are a number of passes averaging 700 feet in height. The Plateau is extremely undulating and broken up by numerous longitudinal and transverse valleys, the general direction of which are respectively at right

angles, and parallel to the bounding chains of hills. The hills generally recede in height as we proceed westward, and are either comparatively bare of jungle; or covered with low jungle.

Climate. 2. The climate of the plateau, which averages 2,300 feet above the sea is away from the immediate vicinity of the high hills, very dry and agreeable, the average range of the thermometer in the beginning of the year being about 28, the minimum being 50, and the maximum 78°. In the narrow valleys, bounded by high hills, the thermometer sinks much lower than mentioned above, and immediately under the Ghauts, the cold is very severe. This is owing to the cold air, which at night rushes down the sides of the hills, and fills the valleys, a phenomenon of almost universal occurrence in all parts of the globe, and particularly observable under mountain chains, as in the present case, running N. and S. and whose slopes consequently receive the sun's rays during only one half the day. It is well known that the atmosphere is but little heated by the direct action of the sun's rays, and that it principally derives its heat by radiation from the earth's surface, and that, moreover, it is when dry, an extremely bad conductor of heat. On these hills covered with jungle, the ground is, however, generally more or less moist and so therefore also the air in its immediate vicinity, and thus the power of conduction being added to that of radiation, these narrow valleys become filled with air several degrees hotter than that of the atmosphere free of them. When therefore that period of the day has arrived, at which the earth ceases to receive heat, and commences to part with that received, the strata of air close to the sides of the hills become heated (above the average prevailing temperature) much mero rapidly than those more distant, the intensity of radiation being inversely as the square of the distance from the radiating point. The portion of the atmosphere then resting on the hill slopes becomes gradually lighter, and would ascend but for the cooler and heavier air, which rests above the hills, which descends by its superior weight, and exerts a lateral pressure on the hotter air, the currents of which (one from either side of the valley) gradually approach one another, mingle and then ascend their upward passage being facilitated by a partial vacuum, or quiescent state of the air medial

to the cold currents. In this manner then there is a constant movement in the atmosphere, the currents of cold air descending the mountain sides, and the steam of hot air laterally forced to the centre of the valley, where they mingle and ascend. This is I conceive the probable cause of the above phenomenon, and if the foregoing reasoning holds good, it would follow that in narrow villages bounded by high hills, the temperature would be sensibly lower than in those distinguished by the opposite characteristics, and this we invariably found to be true. In the case of the great longitudinal valleys of the Plateau the hot air forced along them by the cold air descending the great mountain chain, meets with little or no opposing similar current which compels it abruptly to seek an upward course, and it therefore flows along these valleys gradually becoming warmer by the reception of radiated heat from the ground over which it passes, and then rises and mingles with the superincumbent atmosphere. It is of course followed by the cold air, which also gradually becomes warmer and rises. According to this theory the farther we recede from the chain of high hills, and approach the W. boundary of the Plateau, the minimum of the thermometer will ascend, and this we also found to be the case. The healthiest situations then, and those most eligible for occupation are the wide and extensive valleys, bounded by low bare hills, which are common in the centre and toward the W. edge of the Plateau ; although these are by no means beyond fever range, yet there is nothing at hand which can generate malaria, and it is difficult to conceive that with ordinary precaution Europeans might not pass there with perfect immunity from fever the whole year round. The principal precaution to be observed is to avoid sleeping on the ground, and indeed we should sleep as high above it as can be, as wherever malaria does exist, and it is supposed to be principally owing to the presence of a redundance in the atmosphere of Carbonic acid, a gas of a specific gravity considerably greater than the air, and therefore found principally in its lower strata, it is invariably found that those who habitually sleep close to, or on the ground rarely escape it, whereas those who sleep well above the ground do so very commonly.

The inhabitants would seem to be aware of this, as their villages are almost invariably found on the summits of knolls, or eminences and never in or near the bottoms of valleys, and as it is well known that the natives of this country have not the smallest taste for, nor even have an idea of, the picturesque, we cannot conceive them to have been influenced in their choice of site by considerations of this kind. The mean height of the thermometer in the commencement of the year is (in doors) 64°, and the atmosphere which is dry and bracing has an exhilarating effect on those accustomed to the plains, and more particularly to those who have lived on the coast. The lowest observed minimum occurred at Hookampett, 10 miles from the Madugole Ghaut, where the mercury sank to 40°, and even at 7 A. M. was no higher than 42°. At Minoogooloor, which is immediately under the Ghaut, I had no opportunity of taking a morning observation, but there I am convinced, the thermometer would have been even lower than just stated.

Best season for visiting country.

3. The best season for visiting the country seems to be from the middle of January to the middle of April, and the worst of all, the period between the monsoons and the cold weather. This is according to universal Native testimony, and is also in accordance with the experience of the few Europeans who have visited the country, as also with the results obtained by our own party, which with servants, sebundees, &c., comprised fully 200 men among whom there was no fever, nor since our descent into the low country have any been attacked with it. According to the conceived origin and causes of fever, every principle of logic would point to the hot weather as the best season for going up the Ghauts, but from my own experience during my first visit, and from what I have now gathered, upon extended enquiry I am prone to believe, that the hot weather after the middle of April is not a favorable season for visiting these countries.

Soil.

4. The soil commonly met with on the Plateau is red, containing often, and indeed generally, a large ad mixture of gravel, and admirably adapted for road making. In many places I have observed a red indurated clay, which strongly re-

sembles laterite, except that it does not seem of so cellular a structure. In the bottoms of the valleys the soil is, or is in a great measure, black cotton, the most fertile and best suited for wet cultivation. The red soil seems however to be more favourable to the growth of trees, both fruit bearing and otherwise, of which the most commonly met with, the mango and jack, grow most luxuriantly, and without any artificial irrigation. This red soil will however, when irrigated produce abundant crops of almost every description, and it is well suited to potatoes and European vegetables, which I feel convinced could be produced in any quantity. There is throughout the year abundance of water, and tanks of very large size, and great depth could be very easily made. The soil of the plain country about Jeypore is to the South, black, and this I believe to be more or less its nature as far as the Godavery, but little of it is at present cultivated, although yielding fine crops of paddy and native vegetables, the whole country southwards, presenting to the eye a perfect sea of jungle. It is scarcely possible to conceive a country more highly favored by nature, and which presents greater facilities for cultivation and irrigation, and yet, thanks to the primitive habits, supineness and ignorance of the inhabitants, and to their having come so little in contact with Europeans, no more is cultivated than will suffice for their own consumption, while, with the single exception of iron, scarcely an attempt is made to develope the numerous resources and natural riches of the country. The plain of Jeypore must receive the greater portion of the drainage of the pleateau, which is 30 to 40 miles in width, on which the rain fall must be at least 50 inches per annum, and this coupled with the natural facilities existing for storing large quantities of water, would render the irrigation of the whole plain easy, unexpensive, and most certain. It would be most admirably suited to the cultivation of the sugar-cane, which requires a rich moist soil, free from saline, and rich in nitrogenous matter. The land might of course be had for a mere song, and as fuel can be had to any amount for the mere cost of cutting. I doubt not that a sugar factory would well succeed. The hills in the neighbourhood of the Ghauts seem also to possess all that is required for the successful growth of coffee, they have a

red gravelly rocky soil; with the proper elevation and an eastern exposure, these latter a great desiderata.

State of country, &c. The present state of the country seems miserable enough, as mis-management, and corruption, and violence, seems to be every where paramount. The principal portion of the cultivated lands are Inam, and the most valuable land on enquiry is almost invariably found to be Inam, that leased being of comparatively little value. It would however be difficult for the Rajah, even if so inclined, to discover what is Inam, and what is not, as no accounts whatever are kept; each village appearing to pay a fixed sum, varying from 20 to 200 or 300 Rupees. Of the capabilities of the country, and of what can be drawn from it under proper arrangement, some idea may be formed by a simple statement of facts. The Taluq of Gunipooram has been for some years under Government management, it having been taken out of the Rajah's hands until the arrears due by him to Government are paid. While under the Rajah's management or rather under that of his people, who plunder him right and left, the Taluq did not bring him in anything, and on the contrary was, I believe, a source of loss to him. Under Government management, the Taluq, I am given to understand, now brings in upwards of 60,000 Rupees, leaving after paying the Government pishcush 15,000 Rupees and all expenses a profit of upwards of 40,000 Rupees, which I have every reason to believe might under European superintendence be doubled, and even trebled by developing the resources of the country. This shows how the Rajah, a silly old man, is plundered by the people about him, in whose hands he is as a mere child.

The inhabitants are a muscular healthy looking race, anything but debilitated, as must be the case, were they much subject to fever; their customs are primitive, and their wants few and easily satisfied, and they seem much more docile, uncomplaining and free from cunning and vice, than the inhabitants of the low country, many of them have a strongly Mongolian physiognomy protruding cheekbones, with small, deeply sunken eyes, narrow foreheads and elongated faces. They are generally above the average height, well made, with muscular limbs and appear capable of sup-

porting great fatigue. They speak Oorea, a very simple, but little cultivated language, bearing a strong resemblance to Hindústani, properly so called, i. e. devoid of all Persian and Arabic words, although containing many words used in Teloogoo and derived from the Sanscrit. Its terminations are almost entirely vowels in this respect resembling the Teloogoo and other languages of Southern India, and it is spoken with an accentuation, which bears some resemblance to that used in speaking Gaelic. This would seem to indicate the above to be an ancient race, which has inhabited this country at least centuries before the irruption of the Mahomedans into India, and the Rajah indeed boasts of being descended in an unbroken line from those who ruled the country ten centuries back. He is, moreover, universally looked up to, in spite of his poverty, as the descendant of a very ancient race. His authority although nominally respected, seems really to be little so beyond the immediate vicinity of Jeypore, as each man seems to do pretty much as he likes, while murders and robberies, and all kinds of violence seem common and unrepressed, and even unnoticed, while such seems to be the extent to which corruption is carried by those about him, that a bribe to them will procure immunity from the punishment consequent on the most atrocious crimes. The whole Revenue of the country including the Gunipooram Taluq which as before stated pays upwards of 60,000 Rs. is I believe considerably under a lac of Rs., but there is not a doubt that it could, under European management, and were encouragement given to the employment of European capital, be easily raised to 5 and even 10 times that amount. The great seeming difficulty is the want of population, but that heretofore bugbear fever, dissipated, as I doubt not it will soon be, population would increase as people would from various quarters be attracted to a country where land can be procured at a merely nominal rate, and where living is so cheap. It is a country such as this, to which so little has been done by man, where so much remains to be done, and where that much may be so easily done, that offers the greatest attraction to the employment of new capital, industry, and enterprise, and therefore although it may yet be distant, I do not despair of seeing the time arrive when this hitherto much neglected and unknown country will receive much more of the popular attention. The

road must first however be made, as before that is done, the country is comparatively difficult of access, and to the speculator is not inviting for a visit, however much otherwise it may be to those who are interested in seeing a new and little known country. Iron alone, with which the country abounds, and in great richness too, must one day be a source of great wealth to it, seeing that it can be cheaply produced, and that the demand for it is likely day by day to increase.

Uninviting to the speculator.

Memo. showing the various halting places and their respective heights above the Sea level and distance, &c.

Name of Place.	Height above Sea.	Distance from Vizagapatam.	Distance from foot of Ghaut.	Distance from Calingapatam.
	feet.	mile.	mile.	mile.
Tataparty	220	51	..	
Top of Ghaut	3,200	64	12	
Minoogooloor	2,701	66	14	
Hookampett	2,457	74	22	
Aurada	2,055	94	42	
Soogoor	2,300	104	52	
Dadee	2,310	117	65	
Jeypore	1,533	130	78	
Jeypore by Parvatipore.				
Madheoputhee	1,980	145½	26¾	121½
Devoroputtee	2,395	138	19¼	114
Mirtchmal	2,490	131	12¼	107
Top of Bijya Ghaut	2,783	124½	5¾	101½
Safitambo	2,139	122½	3¾	99½
Tentoolabaddrah	1,166	117	..	94
Parvatipore	....	88	..	65

XIII. *On Timber in the neighbourhood of Cuddapah.* By CAPT. J. H. M. STEWART, *District Engineer.*

(Communicated by Government.)

I have the honor to inform you, that the difficulty experienced in procuring good Timber in the neighbourhood of Cuddapah, and its consequent high price, having frequently been forced on my attention, I determined on examining a range of Hills, on which I had reason to believe, that a variety of useful Wood was to be found. The range to which I allude, stretches due East and West, between the Cheyair and Paupaugnee Rivers, reaching from the town of Nundaloor in the Chitwail Talook, a distance as the crow flies, of 45 miles.

2. It was to the Eastern portion of this range that I directed my attention. I commenced at Goolcherroo, and spent 4 days on the top of the Hills. In the valleys near Goolcherroo, I came upon a large number of fine trees, principally 'Muddy' and 'Yepi.' In one of the lowest valleys, and nearest to the Goolcherroo Ghaut, several 'Muddy' trees had been felled some years ago, and shaped into beams, with the intention of taking them into Cuddapah. This however in the absence of any track, along which wheels could be drawn, was found impossible, and the beams are still lying where they were felled.

3. From a careful examination of the valleys, and of the cattle tracks which lead Westward from them, towards Trunk Road No. XI, I am certain that excellent wheel tracks, for the conveyance of Timber, might be opened out at very small cost. The wheels which I would propose to make for dragging out the Timber would be about $2\frac{1}{2}$ feet in diameter, and about the same distance apart, so that a track of sufficient width could be cleared at very small cost. By clearing a track of about 7 miles in length, several excellent Timber valleys would be brought within easy reach of the high road.

4. I enclose an Estimate amounting to Rupees 650, which pro vides both for this and for the construction of 4 pair of wheels,

&c. I would strongly recommend that it may be immediately sanctioned. It is at present almost impossible to procure good sized Timber in Cuddapah, except at exorbitant prices. Of well seasoned wood there is none to be had at any price. By opening out these valleys at once, the Timber can be brought into Cuddapah, and stored in our Timber yard till required for building purposes.

5. The Hills, at the point of which I have been speaking, vary in height from 1,500 to 1,800 feet above the Sea. Further Eastward, however, they are considerably higher. A point at which my tent was pitched for two days, in 14″ 14′ North Latitude, and 78″ 76′ East Longitude was about 2,300 feet above the Sea, or 1,800 feet above the town of Cuddapah. This was in a valley. The highest point that I reached in the neighbourhood was 500 feet higher, about 2,800 feet above the Sea.

6. In this valley, where I was encamped for two days, there is some very valuable Timber. Two larger plantations of young Teak trees looked especially promising. Of these the largest had been cut and hacked in a merciless manner by the villagers at the foot of the Hills ; and none had been allowed to attain a fair size. I am certain however, that if carefully preserved, these plantations would in a few years become most valuable property. There was also in this neighbourhood a fine show of Yepi and other useful jungle Timber. Altogether I think, that considering the scarcity of Timber, which always prevails in Cuddapah, it would be well worth while to take some steps towards protecting the jungles on this range of Hills from the wanton spoliation to which they have been subject.

7. In one part of the valley, of which I have been speaking, a good deal of ground has been cleared for cultivation by some enterprizing Ryots from the village of Wungymullah, at the foot of the Hills. Hitherto they have grown only Raggi and Cholum ; but during the last few months, some of their fields have been under Indigo. They have also at considerable expense sunk a large Well, and constructed an Indigo Vat, &c. They are now most anxious to make a Tank, by throwing a bund across the valley at a narrow point. They propose to do this at their own expense, and to bring a good deal of land under wet cultivation, on

the condition that for the first four years the rent should be small, Rupees 1-4 per acre. I have strongly recommended their project to the Collector; for their cultivation will not interfere with the Timber; and special encouragement should be given to such a rare instance of enterprize and energy on the part of a Ryot.

8. This project deserves to be viewed from another point. I have mentioned that the valley is 2,300 feet above the Sea Though within 17 miles, in a straight line, from the town of Cuddapah, the climate is almost as bracing as that of Bangalore. In my tent the Thermometer ranged from 45° to 69° during the 24 hours. This was towards the end of January, I have made most particular enquiries on the subject, and every one assures me that Fever is altogether unknown there, throughout the whole year. I cannot but think that the place deserves to be better known. A Road to connect it with Cuddapah might be easily traced, and cheaply made. That such a climate could be brought within two hour's ride of the hottest station in South India is a fact worth knowing.

9. If it were on this ground alone, the proposal of the Ryots to make a Tank in the valley deserves strong support and encouragement. They will have to import labour from the plains for the purpose; and as the Coolies will be afterwards required for cultivation, a Settlement will at once be formed. A small Bazaar will thus be ready on the spot; and the chief difficulty in the way of forming a Sanitarium station will be averted.

10. I should mention, that the range of Hills goes by two names among the Natives. At some points it is called the Policondahs, and at others the Yerramullahs. The former is the more common name. The valley in which they wish to construct a Tank is called by them Yenamullah.

XIV. *On the culture of Sorgho and Imphi.* By M. Perrottet.

[The following paper was received from M. Perrottet by the Committee of the Madras Exhibition of 1859. It was by them transferred to the General Committee of the A. H. S. by whose kindness we are enabled to present it to our readers.

The Hon'ble Mr. Elliot has kindly added to it some notes which are valuable additions to the original.—Ed.]

On the 20th of January last, you did me the honor to send me a letter for M. Montclar, dated from Madras on the 2nd idem,* which had through oversight been forwarded to M. Montbrun. together with six small tin boxes containing some grains of that kind of Sorgho called *Imphi* (Imphi-seed) from South Africa. Subsequently on the 14th February you transmitted a farther supply of other six boxes containing the same Sorgho seed, requesting me to sow them as well as those first sent, and to watch the progress of their development, which accordingly I at once proceeded to do.

I now beg to report the result of these sowings together with the observations made by the Head Gardener, to whom you also furnished a supply of the same seed direct.

The whole of the seeds germinated freely but unequally, and the development of the stalks was completed, although slowly and very irregularly to the ripening of the grain which occupied a period of from 50 to 60 days after the seeds had been sown.

On the first appearance of the plants above the ground they were watered only three times a week, but afterwards daily and more freely in proportion to their growth, and as they approached the period of inflorescence. Under this treatment they attained a height of from 6 to 8 feet, not more, when the formation and ripening of the grain was completed.

I watched the gradual development of these newly introduced plants with much interest, examining their structure with great care to ascertain whether, as had been stated, they really constituted distinct species or varieties. These observations have led me to the conclusion that, in a botanical point of view, they exhibit no appreciable differences whatsoever, that will justify the

* 21 in original.

establishment not merely of new species but even of new varieties, with the exception of one kind only derived from the seed furnished by you to the Head Gardener. I will describe the plant hereafter which appears to me to be new or at least to differ in some degree from the others.

I have, Sir, convinced myself that these supposed varieties, have no existence, certainly not among the plants raised from the seed received from you. They are all assignable to one type, viz., the species known as the *Andropogon Caffrorum* of *Kunth* or the *A. Saccharatus* of *Roxb.* to which an African origin is also assigned.* The appearance and disposition of all the flowering panicles is the same. In nearly all, the ramifications are verticelled or subverticelled, the branches long, slender, flexible, subdivided into numerous branchlets, or spikelets, each bearing many distinct, sessile flowers. The lower flowers some of which are neuter, others unisexual, others hermaphrodite are furnished with a single pedicelled valve ; those higher up on the spikelet have two pedicelled valves representing two narrow lanceolate, acute, downy bracts longer than the grains. These two glumes representing the calyx are concave, beardless and entirely clothed with tomentose white hairs. The stamina are as in the genus, three in number, on capillary filaments, the anthers yellow inclining to light pink. The ovary which is of an oval shape terminates in two longish

* In illustration of M. Perrottet's remarks, I add the following extract from Kunth's Agrostographia i. p. 502.

111. Andropogon Saccharatus, *Roxb. Flor. Ind.* i. 274. Erectus; paniculis verticillatis; ramificationibus nutantibus ; calyce piloso; corollis muticis, hermaphrodita, tri, neutra univalvi. *Roxb.* Holcus saccharatus *Lin. Spec.* 1484—*Willd. Spec.* 4·930. Sorghum saccharatum, *Pers. Syn.* 1·101 = *Host. Gram.* 4 t. 4—Holcus Dochna [ar دخن] *Forsk. Ægyp.* 174, (teste *Delile*)—India orientalis, Arabia, ⊙. An planta Roxburghiana certe eadem ac Linneana ?

112. A. Caffrorum, *Kunth Gram.* 165. Glumis villosis ; seminibus compressis inermibus. *Thunb.*—Holcus Caffrorum, *Thunb. Prod.* 20. *Ejusdem Flor. Cap.* i. 410—*Willd.* Spec. 4·930—Holcus cafer, *Arduin, Saggi di Padov.*—119 *t.* 1. *f.* 1.—Sorghum Caffrorum, *Beauv. Agrost.* 131, Sorghum Arduini, *Jacq. Ecl. Gram.* 25. *t.* 18. Cap. Bon. Spec. ⊙ Sprengel cum precedente conjungit.

styles with diverging feathered stigmas of a deep rose color. The caryopsis (or seed vessel) is oval somewhat flattened at the base, of a fawn color, reddening as it ripens, embraced for one-half, or $\frac{3}{4}$ or even for its whole length by the glumes, which are, as already observed, downy on the outside and terminated by the rudiments of the two styles which are very distinct, leaving as it lengthens, a well-marked line, which seems to distinguish this species from its congeners.

All the plants raised from the seed sown presented the same union of characters the only perceptible difference being in the greater or less degree in which the caryopsis was enclosed in its length and breadth by the two glumes. This peculiarity as above observed is by no means constant, and is wholly insufficient to characterize even a variety.

The species may be described thus :—Andropogon Caffrorum v. β. (constituting a sufficiently marked variety.) Culmo erecto, 2—3 vel pluris nodis glabris, vaginis ciliatis, foliis glabris margine scabriusculis. Paniculâ effusa, samasâ, samis verticillatis, erectis, puberulis, glumis vellosis, muticis, pedicello puberulo, seminibus basi compressis, stylis rudimento coronatis. *(Perr.)*

I have not been able to determine with precision the exact proportion of the saccharine constituent contained in these pretended varieties, having neither the means of ascertaining the precise amount, nor having been able to procure a press of any kind for extracting the juice. I managed, however, with a good deal of trouble to express a portion from a considerable number of stalks which enabled me to ascertain the greater or less degree in which the saccharine property was found in each.

The following are the results obtained by the process of tasting :—

Plants raised from the first six boxes. No. 1. Imphi-seed—2 stalks of 6 to 8 feet high, of very fair growth, thicker above than below,—very sweet, particularly in the upper part of the stalks.

No. 2. Imphi-seed ;—the same as the above.

No. 3. Imphi-seed of Mr. Brownlee, the same results as the above, all being equally sweet.

No. 4. Do. do. also very sweet.

No. 5. Imphi-seed of Mr. Brownlee, These seem to be sweeter than the others.

No. 6. Do. do. The same remark.

Second Trial.

1st. Imphi-seed : Three stalks of the same length, well grown, about 8 feet high—very sweet from the base.

2nd. Do. do. same remark.

3rd. Do. do. of Mr. Brownlee, the same as the preceding in all respects.

4th. Do. do. also very sweet.

5th. Do. do. these appear to be the sweetest of all.

6th. Do. do. differs little in any respect.

Trial of M. Ferrier.

No. 1. Imphi-seed—the same growth as the foregoing both in height and diameter—tolerably sweet.

2nd. Do. do. same remark.

3rd. Do. do. the same remark as for the others.

4th. Do. do. No saccharine matter was found in any portion of these but the plant had not fully arrived at maturity.

5th. Do. do. exactly the same results as the last.

6th. Imphi-seed : as in the two preceding instances the sap was tasteless without a trace of sugar, but the plants it must be allowed, had not attained their full growth, although the grain was perfectly formed.

From these experiments, imperfect as they were, it may fairly be concluded that the slight differences observed in the saccharine property of the cane-stalks are due to the greater or less degree of maturity attained in each instance whenever it may be inferred that in this physiological particular, the plants present no appreciable difference.

I have already stated that the vegetation of these plants, although the soil in which they were grown was in all respects the same has in every instance been very unequal, that the grains (or corns) from which they were raised were themselves very diverse, that is to say they had not all attained the same complete state of

maturity, that in the greater number; on the contrary, the embryo was ill-developed and the albumen (endosperme) red and destroyed by insects, to such an extent that the germ of some of the seeds, although sown at the same time, did not appear above the ground for 4, 5 or 6 days after the others, thus accounting for the inequality of growth above mentioned, and consequently for the disparity also remarked in their sweetness. I believe that these are the causes which constantly gave rise in all countries to insignificant differences leading to the establishment and perpetuation of endless varieties which the ignorant delight to recognize without defining or being able to define them, specifically in any way.

I must add, moreover, that we must not expect always to find the same quantity of saccharine matter in herbaceous annual plants even when they are grown under the most favorable circumstances, provided that is, that the saccharine product is not, as in the sugar-cane the principal constituent of the plants, but on the contrary it only shows itself when the formation of the grain begins to take place, and when the floral panicle is fully developed. It does not even attain its maximum until all the grains have been completely matured, and even then it begins to fall off in quantity. It is especially remarkable that this maximum of saccharine principle is only manifested distinctly at the top of the stalks, and that the lower portion next the earth exhibits often nothing more than the slightest trace of sweetness. I must add, however, that such is the case only after the grain has become quite ripe. Before that period I have found the stalks sweet, throughout their whole length, but always in an inferior degree towards the inferior extremity. Hence it follows that it is necessary to watch, so to speak, the most favorable moment for cutting the plants.

With regard to the saccharine richness of the so called varieties of this African Sorgho which as I have already said are all referrable to a common type, the *Andropogon Caffrorum* of *Kunth*, it would appear according to Mr. Wray to be very remarkable, and of a nature to attract the attention of sugar growers. In the last number of the Journal of the Imperial Zoölogical Society of Acclimatation he thus expresses himself:—

"I have cultivated" says he, "these 15 varieties or species and have made sugar from them all. This trial has made me acquainted not only with the saccharine richness of each kind, but also with the conditions of their growth and their yield. My manufacture has given such successful results that I left Natal to return to Europe in order to pursue my discovery, and to announce to the manufacturing community the importance of these plants in the production of sugar."

Another writer M. Don Julien Pellony Rodriguez states in the same Journal, that the canes or stalks of these several varieties of Imphi weigh from 4 oz. to 3 lbs., that the canes are firm and contain from 50 to 80 per cent. of sweet juice, yielding from 10 to 16 per cent. of sugar. If these facts are correct and I have every reason to believe they are, the cultivation of this plant will, at no distant period bring about a revolution in the sugar trade. For if I am not mistaken, the sugar cane which requires a growth of a year and more in certain localities to arrive at the maximum of production does not yield much more, if it does exceed that.

In Cayenne for example where I took part in the experiments of an able sugar boiler with the most perfect means of extraction in use at the period, we certainly obtained 22 per cent. of very fine sugar, but that was probably an exceptional result.

It must always be matter of surprize that although these plants have been known upwards of a century (for they had been identified in Linne's time, who named the one under consideration *Holcus* Saccharatus). It must, I repeat be a subject of surprize that no one had tried to turn them to account or to work them with reference to their saccharine properties. Is it because this sugar which is found in the plant in the state of *glycose* is difficult to extract and difficult to obtain in a state of perfect crystallization that its culture has been neglected? This is the only conclusion we can come to, and in it we must include the Chinese Sorgho of M. Montigny, the *Andropogon niger*, which has been equally well known for a long time.

For my own part, I see reason to believe, that the extensive cultivation of these plants highly saccharine, as they are within any given period, will always be attended with great difficulty,

inasmuch as their roots which have a constant tendency to rise and to run along the surface of the soil are unable to keep the plant from bending and inclining towards the ground with the slightest wind, particularly when the head is full of grain. This alone is sufficient, sometimes, without a breath of wind, to drag the plant down to the earth, the consequence of which is that it throws out shoots in this recumbent position and becomes so altered that it is no longer possible to extract the sugar which in fact is completely destroyed. But even when the sugar is obtained it is found to be of a different quality from cane-sugar properly so called. It is found as those who have worked it admit —to crystallize with difficulty nor are the crystals themselves well defined. The juice of the Sorgho differs entirely in taste from that of the *Saccharum Officinarum*, being more insipid, thinner, the impression on the organs of taste evanescent or of the shortest duration and more fit for conversion into Rum than Sugar, such is the opinion of those who have tested its qualities by experiment.

The cultivation of these plants with a view to the production of grain would, I am persuaded prove very remunerative because they will yield two or three crops a year in this country, especially as the seeds or corns are larger than those of other species and the heads full and much branched. They abound in gluten and amylaceous particles.

The Natives who have examined these seeds consider them superior to their own kinds which they have cultivated from generation to generation, that is those of the Imphi Andropogon Caffrorum. As for those of the Chinese species or *And. niger*, they seem to care little about them, and the plant will never enter largely into their culture, notwithstanding they are very sweet, but not more so than the Imphi which is perhaps the sweetest of the two.

The above remarks were drawn up entirely with reference to the produce of the first six boxes, but apply equally to those of the last six which presented no appreciable difference. I have no further botanical remarks therefore to add to this part of the subject.

Such, Sir, are the results of the examinations and discoveries I have been able to collect up to this time from the seeds you did

me the favor to send. Those produced from the seed which you sowed yourself offer nothing calling for remark, hereafter I may be able to continue and extend my observations and experiments and to submit a special treatise on the subject embracing whatever information the time at my disposal will enable me to make.

Be good enough, Sir, to bring this report, incomplete as it is, to the notice of M. Montclar, and to ask how we can send him the seed which we have reaped in considerable quantity.

Meantime accept, Sir, the expression of my most devoted and sincere duty.

(Signed) PERROTTET.

The foregoing valuable report of M. Perrottet fully confirms the remarks I made at a former meeting, when the subject of the Imphi seed was first brought before us. I then stated my belief that this newly introduced variety would not be found to differ materially from the Andropogon (or Sorghum) Saccharatus which is grown extensively in the Ceded Districts and Southern Mahratta country, and with the cultivation of which in the latter country where it is known among the Mahrattas, by the name of Shalu, (I was familiar during many years.)

Naturalists particularize seven defined species of Sorghum as cultivated in S. Asia—fifty-six specimens of Sorghum were submitted under different names to the Exhibition of 1857,* and the number might probably have been increased from the dry grain districts.

I have always suspected that most of these are referrable to a single normal type, and that the numerous varieties are due to the long period of domestication during which this grain has been cultivated as the staple food of the people in the unirrigated tracts of Africa, Arabia, Persia, India, China, &c.

The seven species enumerated by Kunth, examined pp. 501-2, are the following :—

1. ANDROPOGON SORGHUM, *Brot.*	5. ANDROPOGON RUBENS, *Kunth*
2. ——— NIGER, *Kunth.*	6. ——— SACCHARATUS, *Roxb.*
3. ——— CERNUUS, *Roxb.*	7. ——— CAFFRORUM, *Kunth.*
4. ——— BICOLOR, *Roxb.*	

* Jury Report of 1857, p. 36—3.

Of these, Sprengel has pronounced the 2nd to be a mere variety of the first, and the 7th to be a variety of the 6th.

Persson makes the 4th and 5th variety of the first, and Willdenow admits the latter (5) to hold only an intermediate place between the 1st and 6th. Lastly, Roxburgh in describing the 3rd calls it a species or *variety* of Sorghum (No. 1.)

This is the opinion of distinguished botanists, the group is reduced to two admitted species.

1. Andropogon Sorghum, *Brotero.*
   - *a.* Niger, *Spreng.*
   - *β.* Bicolor, *Pers.*
   - *γ* Rubens, *Pers.*
   - *δ* Cernuus, *Roxb.*
2. Andropogon Saccharatus, *Roxb.*
   - *a* Caffrorum, *Spreng.*

In examining a great breadth of Sorghum cultivation, it is impossible not to be struck with the marked diversities of form, size and color exhibited by the plant in different localities.

I had occasion to make a careful examination of the Sorghum crops in Rajahmundry in 1853, and passed through a succession of fields from the rich deep alluvial lunka lands in the Godavari, to the shallow stony soils on the uplands, exhibiting every variety of appearance, from the large dense coarchate head to the loose panicle, the branches of which sometimes upright, sometimes drooping, the colors varying from pure white through every shade of yellow, pink, red and brown to black ; the height differing from 3 feet to 30.

A large head not selected but taken at random from a lunka field contained 5618 corns and weighed $10\frac{1}{2}$ oz.

A head from an intermediate field contained 3856 corns and weighed 4 oz.

The average heads of the upper lands were not half the size of the last, many were still smaller.

In the Exhibition Catalogue of 1857 we find the common.

Red Cholum.

White do.

Yellow do.

Alangkáru small, milk-white, Chingleput and Canara.

Shan Cholum, a red variety, Tanjore.

Chella Cholum from Cuddapah.

Argudia Jowari from Hydrabad.

11 varieties of white, 4 of yellow, 3 of red,*	Jowari from do. by Capt. Taylor, Raichore Doáb.

Dud-Mogra white and pink, *flat* grain, by do. do.

Káhkái Chólam or black cholam from Tinnevelly, under which name also the Sorgh. niger was sent from Pondicherry.

Mutta Chólam.

Mappa Cholam.

Mandaru Cholam.

In the Exhibition of 1859 we find from Cuddapah besides the red and white kinds.

Bhat wâni—Kal nakki jowar.

Eaji wáni.

Dud-mogra.

Chandal wáni.

Jipúr.

Wunga.

From Mysore.

Koluda jola.

From Raichore Doab.

Millije jola.

Bilapla—Urinjola.

Kea.

Nír.

From Trichinopoly.

Maskata Jolam—(Q. An Arabian variety ?)

From Tinnevelly.

Karuvi Cholam.

If all these varieties could be subjected to the same careful examination and analysis as the Imphi plants have received at the hands of M. Perrottet, we should be able to pronounce with precision on the question of identity of species.

* Bhendya or Lamdi.

In the present state of our knowledge we are justified in limiting the number of distinct species to two kinds.

With regard to the practical part of the subject I think the Society may safely intimate to Government that no advantage will be obtained from a larger importation of foreign seed; that the sugar yielding species is already extensively cultivated in this Presidency, and that persons interested in the sugar trade have ample means of obtaining material for the manufacture.

M. Perrottet has observed that the grains or corns of the Imphi and of the Chinese variety are larger and finer than those of the common chólam, but that the ryots do not care to sow them.

This remark suggests the importance of employing greater care in the selection of the indigenous seed. From the remarks noted above on the Sorghum of Rajahmundry, it will be seen how striking are the diversities in the quality of this grain grown in a single district.

I have no doubt that if pains were taken to secure the employment of the best description of seed only, and if seed was supplied from one province to another, the indigenous grain would be rendered equal in every respect to the African and Chinese varieties. For this purpose the largest and finest corns should be selected by passing the seed through sieves like those used by pearl merchants which should retain all the larger seeds suffering the small and imperfect ones to pass through. In the experiments made at Rajahmundry I found that 100 selected corns weighed 52 grains, another set 53·3, while similar parcels taken at random weighed 42·5, 44, and 46 grains.

The subject seems to be worth the attention of the Local Exhibition Committees, who might offer rewards for samples of seed-corns in quantities of not less than a candy or other measure not too small, 100 or 1,000 corns of which taken at random should weigh the heaviest, taking the average of several successive parcels to ensure a fair examination.

Prizes might also be offered for the best produce certified to be raised from such prize seed.

SELECTIONS.

On a Method of cooling the Air of Rooms in Tropical Climates. By PROFESSOR PIAZZI SMITH, *Astronomer Royal for Scotland.*

Before an inventor can expect to enlist any interest in his labours, he must fully state the case to which they refer, must show that sufficient importance attaches to it, and should give an account of what others have done in the same direction before him; so that it may be generally understood at what point of the question he has taken it up, and whether he has really and essentially advanced it. The limits of this article will not allow of these desiderata being so fully treated of as they deserve, but very few persons in this country having had the opportunity of becoming practically acquainted with the case, of experiencing the intense necessity of some alleviation of the evils which it brings, and of witnessing the imperfect action or the mistaken principles on which the various remedies act which have been attempted up to the present time, some small portion of the space which ought, perhaps, more strictly to be devoted to *new* matter, may be profitably employed for this purpose.

The heat which is occasionally felt in temperate climates, cannot call for any serious means of alleviation, as it never rises to a degree dangerous to health, or obstructive to business; it never lasts long, and there are always means of tempering it, in the coolness of the nights and of the winters, as stored up for our use in the earth, cellars, wells, springs and mountains. Nor is the heat of the countries between the temperate and the torrid zones such as to call for much attention; its general characteristic is dryness, constant blue sky and sunshine; the heat is felt there as *radiation* rather than *temperature;* the rays of the sun are scorching; but, in the shade and at night, coolness is to be obtained. Such a climate is very healthy, as is shown by the instances of the Cape of Good Hope and Australia. Working in the open air may perhaps be too severe for some European constitutions, but those whose

employment is in-doors, may get through their business, nearly as well as in this country.

But it is in tropical climates, especially along the sea-coasts of continents and on islands, where heat exists in its most baneful form, as high temperature through day and night, summer and winter; the sky may be constantly cloudy, or clear by day and rainy at night, the rain descending in a temperature of 80° Fahr. and upwards. In such a climate the shade of trees or of a roof brings no alleviation of the heat; it is felt almost equally all through the night, and throughout the winter as well as the summer. A person employed in-doors is working in the same high temperature as one out of doors; there is no escape from the heat either by building houses high up into the air, or sinking them low down into the ground. Rivers, springs, rain, the ground, every thing will be of the same temperature as the atmosphere, and that temperature is far too high for European constitutions.

Against a moderate continuance of such an untoward climate as this, a strong constitution might bear up; but when this state of things goes on month after month, and year after year, the human frame becomes completely relaxed; all energy of mind and body is destroyed, and disease finds easy victims. We have but to turn to any statistical account of life, or rather death in India, to see the immense sacrifice that is yearly being made there to the climate. Doubtless many of the deaths may have arisen from indirect effects of heat, such as miasma, which it is not within the province of this paper to touch on; but still multitudes will be left amongst both soldiers and officers, and civilians of every degree, due merely to the living in too high a temperature; which prevents the skin, the lungs, and the liver, from performing their duties, and utterly relaxes the whole component tissue of the body, producing such diseases as *prolapsus ani.*

This now is the case to be met, and for proofs of its sufficiency of claim to earnest attention, let any one look merely to their own friends or relations who have gone out to India, and let them also consider those who have been so fortunate as to return, with more or less grievously shattered constitutions.

It may be objected, that no plan of cooling rooms, though

ever so effective in itself, can be of avail to by far the greater number of cases, where the persons are employed chiefly in the open air. It is true that it will be of no use to them when they are there, but if they can be insured, when the day's work is over, a *cold* house to retire to, and a sound sleep in a cool atmosphere; that may completely reinvigorate their bodies, and make up for all that has been undone by the heat outside, in the same manner, as in cold countries, men are enabled to withstand excessive severities of cold in open air employment in the daytime, if they can recruit their stock of heat at night in a warm lodging.

In cold countries when the air is lower in temperature than is agreeable, nothing is easier than by lighting a fire in a room, to raise the heat to anything that may be desired. But when the air is too high in temperature naturally, and in one of those tropical climates where day and night, and summer and winter, the heat is never under 80°, and where the air being saturated by moisture, there is no coolness from evaporation, then the converse of lighting a fire, that is to say a method of actually lowering the temperature of the air, without producing any other change in it, has never yet been brought about. Some method of this sort, however, seems indispensable to give European life a fair chance in the tropics; and the method which I am about to detail, is my contribution to a subject, which I trust will receive continued attention until the problem is completely and satisfactorily solved.

On the methods hitherto adopted, much time need not be spent; for 1st, the *fan* mat, or "*punkah*," is merely a fan which agitates the air in a room already hot, but does not actually cool it, or produce any regular or salutary ventilation. 2nd. The *wet mats* in the windows for the wind to blow through, cannot be employed but when the air is dry as well as hot; and even then are most unhealthy, for although the air may feel dry to the skin, there generally is far more moisture in it than in our own climate; but the height of the temperature increasing the capacity of the air for moisture, makes that air at 80° feel very dry, which at 40° would be very damp. Now, one of the reasons of the lassitude felt in warm climates is, that the air expanding with the heat, while the lungs remain of the same capacity, they must take in a smaller quantity

of *weight*, though the same by *measure* of oxygen, the supporter of life: but if, in addition to the air being rarified, it be also still further distended by the vapour of water being mixed with it, it is evident that a certain number of cubic inches by measure, or the lungs full, will contain a less weight of oxygen than ever; so little, indeed, that life can barely be supported, and we need not wonder at persons lying down almost powerless in the hot and damp atmosphere, and gasping for breath. Hence we see that any method of cooling the air for Indians, instead of adding, should rather take moisture out of the air, so as to make oxygen predominate as much as possible in the combined draught of oxygen, azote, and a certain quantity of the vapour of water, which will always be present; and hardly any plan could be more pernicious than the favourite, though dreaded one by those who have watched its results,—of the wet mats. Cold air, i. e. air in which the thermometer actually stands at a low reading, by reason of its density, gives us oxygen, the food of the lungs, in a compressed and concentrated form, and men can accordingly do much work upon it. But air which is merely cold to the feelings, air in which the thermometer stands high, but merely gives us one of the external sensations of coldness,—on being made by a punkah or any other blowing machine, to move rapidly over our skin; or on being charged with watery vapour, or on being contrasted with previous excessive heat; such air must nevertheless be rarified to the full extent indicated by the mercurial thermometer, and gives us therefore our supply of vital oxygen in a very diluted form, and of a meagre, unsupporting, and unsatisfying consistence. The only other Indian plan to be mentioned, is shutting up the house in the middle of the day, and opening it only at night or towards morning; but this evidently will not suit the strictly tropical heat, and can only be employed in the northern and inland portions of India, where the climate is more nearly like that of the "radiation" countries, where the nights are cool; for otherwise, the closing of a room will evidently be no safeguard against the heat which has already saturated the walls, the roof, and the floor; and if a human being be enclosed in that space, he will evidently warm up the confined air, in addition to contaminating it by his respiration. The *sine quâ non*,

therefore, for healthy and robust life in tropical climates, is air cold and dry, cold to the thermometer, and dry to the hygrometer, or in other words, dense, and containing little else than the necessary oxygen and azote, and this supplied to a room, fresh and fresh in a continued current.

The method by which I propose to accomplish this consummation, so devoutly to be desired, is chiefly by taking advantage of the well known property of air to rise in temperature on compression, and to fall on expansion. If air of any temperature, high or low, be compressed with a certain force, the temperature will rise above what it was before, in a degree proportioned to the compression. If the air be immediately to escape from under the pressure, it will recover its original temperature, because the fall in heat, on air expanding from a certain pressure, is equal to the rise on its being compressed to the same; but if, *while the air is in its compressed state, it be robbed of its acquired heat of compression*, and then be allowed to escape;—it will issue at a temperature as much below the original one, as it rose above it on compression. Thus the air, being at 90°, will rise, if compressed to a certain quantity to 120°; if it be kept in this compressed and confined state until all the extra 30° of heat have been conveyed away by radiation and conduction, and the air be then allowed to escape, it will be found, on issuing, to be of 60° of temperature. If a cooler be formed by a pipe under water, and air be forced in under a given compression at one end, and be made to pass along to the other, it may thereby, if the cooler is sufficiently extensive, be robbed of all its heat of compression, and if the apparatus is so arranged, as it easily may be, that at every stroke of the pump forcing in air at one end of the pipe, an equivalent quantity of the cooled compressed air escape from under a loaded valve at the other; there will be an intermittent stream of cooled air produced thereby of 60° Fahrenheit in an atmosphere of 90° in the numerical case just given, which may be led away in a pipe to the room desired to be cooled.

So much for the theoretical principle of this operation, of as it were, squeezing the heat out of the air; but before thinking of it for practical purposes, it is necessary to ascertain what is the thermotic effect of compression, i. e. how many degrees in temperature

a certain quantity of air will rise, on experiencing a given compression. On this, combined with the cost of mechanical power at the place, will depend the expense and the consequent feasibility of the method. Seeing that that can be accomplished by this method, which has not yet been brought about by any other, it is probable that it might be adopted by the wealthy who are dying from heat, although it might be very expensive ; and in hospitals, also, where many subjects are concentrated together, and are more immediately in want of the benefits of cool air—the plan might be adopted, although very troublesome ; but it fortunately turns out that the thermotic expansion is so very great, that the machinery can therefore be made very simple, and can be worked so cheaply, that private persons of ordinary means may indulge in the luxury ; and a house may be cooled in India for probably about the same that one can be warmed in England.

The mere fact of compression and expansion having a thermotic effect on air had long been known, but no one seems ever to have thought of applying it to any decidedly useful purpose, certainly not this one ; and for that reason, perhaps, the exact quantity of thermotic effect had never been investigated with precision ; and when this idea first occurred to me in 1843. I could procure no data which would enable me to calculate its practicability within any moderate limits. The next year, however, I had a small apparatus constructed for testing the matter experimentally ; and though no great exactness was arrived at, still it appeared that sufficient grounds were obtained to warrant the communication of the idea to several friends in 1845, as a possible mode of accomplishing the end in view. In 1847, I had a larger apparatus made, and in the beginning of 1849, communicated an account to the Royal Society of Edinburgh.

Experiments, however, with small apparatus, are very uncertain, where heat is concerned ; and in this case the results were not by any means so favourable as they might have been, on account of the great radiation and conduction of heat, due to the diminished size of the metallic vessels, and the consequence preponderance of surface to cubical contents. But in the latter end of 1849, I was

enabled, through the kind intervention of Mr. Stirling, C. E., to try the experiment on as large a scale as could possibly be desired.

At the Kinniel Iron Works (the nearest works of that description to Edinburgh,) air is pumped into a series of blast furnaces by a powerful steam-engine, under a pressure of 3·5-lbs. on the square inch. The air pumps are two in number, double acting, with cylinders about 5 feet in diameter, and 10 feet stroke ; so that, in so far as a compression of 3·5-lbs. could serve, the volume of air was prodigious, and completely removed all fear of sensible error arising from the frictional heat of the piston, or from radiation at the surface. Mr. Wilson, the owner of the works, very kindly, on the application of Mr. Stirling, gave every facility for trying the experiments, and I had a new thermometrical and mercurial gauge apparatus constructed for the purpose.

The observations, which it is needless here to detail in full, as they will appear elsewhere, were made in the presence, and with the assistance of Mr. Stirling, C. E. and Lieut. Driscoll Gosset, R. E.; and consisted in determining, by a considerable number of trials,—

1st. The temperature of the air entering the valves of the air pump.

2nd. The temperature of the air in the large air vessel, into which it had been forced by the pumps under a certain pressure. 3rd. The degree of that pressure; and 4th. The temperature of the air on issuing out into the atmosphere from under that pressure. For these last it was necessary to bore a hole into the air chest, and this Mr. Wilson most freely allowed us to do, and the hole being above one inch in diameter, the rush of air out of it was more than sufficient to completely enclose and fully inpress its temperature on the bulb of the thermometer.

1st. Temperature of entering air 63° Fahr.

2nd. Temperature of compressed air 92°.

3rd. Compression 7·2 inches mercury.

4th. Temperature of escaping air 63°

The Barometer was about 30 inches at the time. The temperatures may be considered to be determined certainly within a degree less or more, and the pressure within one-tenth of an inch. Hence we have, with a very small probable error, a compression

of 7·2 inches of mercury—less than $\frac{1}{4}$ of an atmosphere—raising the temperature of air 29° Fahr. or from 63° to 92°; and on being allowed to escape and expand from that pressure freely into the atmosphere, the fall of temperature is also 29°.

This result was immensely above what any friends to whom I had mentioned the matter had anticipated, and they would have been inclined to doubt, had not these experiments been so unexceptionable in the huge scale of the pumps employed. The workmen at the place were well aware of the heat of the air in the compressed vessel and pipes, and the instant that the hand was laid on the large reservoir into which we bored the hole, the great increase of heat was perceived. The men had very absurdly, but very confidently, been in the habit of attributing the heat to the friction of the air in the pipe; but, in the first place, the air was almost stationary in that pipe, which was some five feet in diameter; and, in the next place, when the air was allowed to escape through a 1 inch pipe, and so produce incomparably more friction, the fall of 29° was obtained, instead of any further increase.

Professor W. Thomson being employed on the theory of heat about this time, and being engaged in preparing an account of Carnot's theory, I applied to him to know what the increase of heat would be, if air at 70° Fahr. was to be compressed $\frac{1}{4}$ of an atmosphere, the barometer being 30 inches. He replied, that some of the elements required for the calculation were not exactly known, but that, as near as he could compute it then, it would be 30° Fahr., which is a remarkable confirmation of the 29° for 7·2 inches derived from experiment.

Mr. W. Macquourn Rankine, C. E. who last winter produced his mathematico-mechanical theory of heat, states, that it gives the same result as the above; so that, for practical purposes and small pressures, we may take very safely 4° Fahr. as being the rise in the temperature of air for 1 inch pressure of mercury, and 30° Fahr. for 7·5 inches, or $\frac{1}{4}$ of an atmosphere; and Mr. Rankine further computes that a theoretical Horse-power working one hour, will be sufficient to lower 9,000 cubic feet of air 20° Fahr. without any deduction for friction.

Making a very liberal allowance for friction, for loss of effect by radiation of heat, and for imperfect cooling of the compressed air, and

calculating from the Kinneil experiment, a one horse power (which in India would generally be represented by a pair of bullocks,) and might cost, with their driver, two shillings per diem (would be enabled to furnish a room with 50 or 70 cubic feet of air per minute, 20° Fahr. below the surrounding atmosphere. This being a quantity of air abundantly sufficient for the breathing of one or two persons at least, and 20° being quite sufficient depression of temperature for the inside of the room below the atmosphere outside, we see that, in so far as the element of mechanical force is concerned, the expense is nothing extraordinary; certainly trifling to an Indian purse. In some places the regular blowing trade-winds, and, in others, water power, may give the means of producing mechanical force still cheaper. Sometimes the abundance of fuel may render a steam engine convenient, but seldom need the necessary power cost more than the bullock hire; and this element of expense, which is to be compared, in the warming economy of colder countries, with the price of coal, is reduced within very possible limits indeed.

But we have next to consider the form and size of the apparatus to which the mechanical power shall be supplied, not only in order that this may be used to the best effect, but to contract as much as possible the first cost of the whole; a capital to be compared to that sunk in cold countries, in furnishing a house with grates and chimneys. Then a method has to be devised of supplying the air, thus produced, to a room in such a manner as to produce perfect ventilation; and, lastly, a plan of *drying* the cooled air, should that be found necessary, as it is not at all improbable.

Before the form of the apparatus can be arranged, a necessary preliminary is to decide on the most proper degree of compression to be worked to; especially to ascertain whether the force of the compressed air may not be usefully employed in assisting to compress more air; the apparent advantage being then, that the mechanical power consumed would be little more than just sufficient to overcome the friction of the machine, and make up for leakage; the power employed for the compression of the air being all got back again on its expansion, and this great economy of force greatly over-balancing the attendant disadvantage of increased complexity in the apparatus.

But however specious this application may appear, it fails altogether in practice, for several reasons; first, the difference between the perfect expansive action of the air undergoing compression in the pump-barrel, and the imperfect expansive action of the same air in the expanding working-barrel. In order to insure any effect at all, a considerable degree of compression must be employed, or the force of the expanding air will not be equal to the friction of the additional piston, and other apparatus required for its introduction. The action of compressed air would be very similar to that of high pressure steam, and that not being a profitable source of power, until the tension has reached several atmospheres, the air should not be employed at less. But then the difficulty is experienced, that the air having been forced into the cooler by the pump, and deprived then of its heat of compression, occupies less space than before; and this deficiency increases with the compression, as does also deficiency from leakage. While too the air, in undergoing compression, was offering resistance to the power from the very commencement of the stroke, and that power was not producing any effect that could be considered useful, until when, towards the end of the stroke, the compression in the cylinder, exceeding that in the cooler, the air begins to be forced therein; it is to be remembered that owing to the imperfection of the best cylinders, valves, and such apparatus that can be made, only a small proportion of the expansive force of the air or steam can be employed, and the part so lost, increases with the compression adopted.

Again; from the excessively varying resistance of air when undergoing great compression, such violence is done to all parts of the pump, that it cannot continue long to work tight and true—and this was the principal reason of the abandonment of the Croydon atmospheric line; the air, in undergoing compression, came so suddenly to a maximum of resistance, as to resemble an explosion in its effect. The great inertia and small elasticity of water, render that fluid most appropriate for being raised by pumps acted on by natural powers; but the small inertia and great elasticity of air, render it almost impossible to be dealt with continually at high degrees of tension.

But the most important objection to the employment of a high degree of compression, which is necessary to the introduction of

the expansive action of the air at all, exists in the difference between the amount of increase in temperature on a certain compression, and decrease of temperature on the same quantity of expansion in air; a difference not practically sensible in low compressions, but so very much so in higher ones, as to waste the mechanical power in producing heat, which can never be made up for by the small amount of subsequent cooling. In any particular compression, a certain per centage only of the acquired heat can be got rid of in the cooler; unless therefore the decrease of heat on expansion notably exceeds the per centage of heat of compression still remaining, no absolute cooling on the initial state of the air will be effected. Thus, let the heat produced by a certain compression be 17°, and let 7 per cent. of that heat be got rid of in the cooler, leaving therefore 5° still outstanding, the decrease of temperature consequent on the same expansion will be 16°, and the amount of cooling consequently 16—5, or 11°, and only 1°, or 17—16 will have been produced.

But let such a compression be employed as shall produce an increase of heat of 1850°, 7 per cent of this being cooled off, leave outstanding 555°; and the decrease of temperature consequent on the air expanding from that compression, being only 398°, leaves outstanding still 157°; or the air sought to be cooled is, after all, heated to that great extent above what it was at first, and the enormous amount of 1452° of heat, or 1850—398, have been uselessly produced; and this, however perfect the method or complete the degree of cooling, and the carrying away the heat of the compressed air may have been.

The effect of this law of the different results of compression and expansion being thus important, it becomes necessary to ascertain its exact amount; and as this is hardly possible to be done by experiment, unless very great expense be incurred, recourse must be had to theory; and this may be carried out with perfect safety, when one point in the scale has been so satisfactorily fixed by the Kinneil experiment. Both Carnot's and Rankine's theories are, however, rather difficult in their application, and depend on the specific heat of air, a quantity by no means well defined. A new theoretical view has however been just produced by my friend, Mr. W. Petrie, C. E., and has the advantage of being immediate in its result, and de-

pending on no theory of heat, but merely the fact of heat being the cause of the apparently self-repulsive or expansive power of gases, and on the well-determined amount of this expansion of gas by heat, viz. $\frac{1}{480}$ for 1° Fahr.

On this well grounded idea he has computed a table, showing the decrease and increase of temperature on certain amounts of expansion and compression of air; and the truth of the table, and the idea on which it is founded, are well borne out by the close agreement with the Kinneil experimental results already detailed. The table is as follows:—

Variation in the bulk of a portion of air.	Variation of temperature from 60° Fahr. produced there by degrees	Variation in the bulk of a portion of air.	Variation of temperature from 60° Fahr. produced there by degrees.
Expanded to 00	508·0	1·2	30·0
1000 vols...	457·2	1·1	15·9
500	444·0	1·0	0·0
200	421·0	Compressed to 0·9 of the vol.	+ 17·1
100	398·0	0·8	+ 39·1
50	370·0	0·7	+ 64·2
20	320·8	0·6	+ 94·3
10	272·2	0·5	+ 132·0
5	210·9	0·4	+ 181·5
3	155·9	0·3	+ 251·0
2·5	133·7	0·2	+ 360·7
2	104·8	0·1	+ 586·4
1·9	97·9	0·05	+ 870·9
1·8	90·4	0·02	+1363·5
1·7	82·3	0·01	+1850·1
1·6	73·7	0·005	+2462·8
1·5	64·2	0·002	+3524·0
1·4 ...	53·9	0·001	+4572·0
1·3	42·5	0·000	+ ∞

To adopt this table to any other initial temperature than 60° Fahr. add $\frac{1}{508}$ to the tabular quantity for every degree by which the temperature is higher, and subtract the same for every degree by which it is lower.

The merest glance at this table shows the advantage of using the lowest compression compatible with the quantity of cooling required; and further, that this degree of compresson will, in all ordinary cases, be so very trifling that the expansive force of the escaping air would not overcome the friction of the apparatus on which it would have to be employed if utilised mechanically. The machine resolves itself, therefore, into a pump, as simple as could

be desired in the colonies, where good mechanical workmen are generally scarce.

The size for a one-horse power engine, or its near equivalent, two bullocks, and working at $\frac{1}{2}$ of an atmosphere pressure, so as to give about 90 cubic feet of air per minute, and cooled at least 20°, making full allowance for losses from various sources, would be 1 foot in diameter, and 1·5 in length, or in the stroke ot the piston, the number of strokes being about 30 or 35 *double* ones per minute. This gives a speed to the piston of only 90 or 100 feet per minute, but it is much better to have a large pump moving slowly for this purpose, than a small one moving quickly, as in this case so much needless heat would be produced by the friction of the pistons. The slow motion of the bullocks can likewise, in the former case, be so much the more easily converted into the necessary speed for working the pumps, and would be done on the supposition of the diameter of the bullock path being 30 feet; and it should nol be less, to allow the animals to have a fair and straight pull, and their rate of walking two miles an hour, by two sets of wheels and pinions, the first from the large cog wheel on the bullock shaft producing an increase of 5 or 6 times, and the second about 3. A good engineer should be employed for the pump, and metallic piston and valves be adopted; and the whole should be fitted in to a frame in this country, with connecting rod and crank axle applied, so that it might be easily adapted to any existing Mills in India; and that no injury should haply accrue to the piston or the interior of the barrel by clumsy workmen inserting too long or too short a connecting rod.

The next part of the apparatus is the cooler, which may be made in various forms, as a copper pipe, one or two inches in diameter; very thin, in order to conduct heat more readily, and about 100 feet long, with a spring valve at the end farthest from the pump, and capable of being loaded with any particular pressure per square inch which it may be desirable to work at. The pipe may be conveniently coiled up and placed in a barrel full of water, entering at the top, and leaving it at the bottom; so that the air, gradually cooled as it goes along the pipe, may meet the coldest water at the bottom of the worm, and thus be more completely refrigerated. A small supply of fresh cool water from the river or spring or tank, or

wherever the supply is drawn from, must be allowed to trickle into the tub, and be conducted by a pipe to the bottom, while an exit being made at the top, the water heated by the compression of the air, will flow off in a continued stream. I have not yet made any experiments on the quantity of cooling surface of pipe required, but a few feet more or less will certainly accomplish it, and will not much increase the expense of the first apparatus which may be made.

The proposed form is shown in fig. I., where on the left hand side is shown the double acting pump, which compresses the air into the pipe in the tub, where it accumulates until of sufficient elasticity to raise the loaded piston valve on the right; a portion then escapes until the remaining air is less elastic than the pressure on the valve; and at every succeeding stroke of the pump, a quantity of air, equivalent to that forced in at one end of the pipe, will escape from the other end, after having parted with its heat of compression to the water, and expending immediately, and cooling will be available at once for the sanitary application to rooms.

The form of cooler mentioned above, is but one of many which may be variously applicable in different situations; a flat cooler may be preferable, and often it may be of advantage to pass the compressed air through another coil of pipe, over which water is allowed to drip, or which is covered with a damp cloth, so that the cold of evaporation may be superadded to any procurable from the temperature of the water.

The next point is the application of the cooled air to a room, so as to keep it effectually cooled, and at the same time well ventilated; and this is, fortunately, very easy to be done, and in the most perfect manner.

The cold air being heavier than warm air, cannot be applied to upper rooms, or even to lower rooms, with doors and windows reaching down to the ground; for it will escape there as water would, flowing away, and diffusing itself every where over the lowest places. But if a wall, several feet high, be built all round the room proposed to be cooled, or, still better, if it be sunk that depth in the ground, the cold air will be confined as if in a tank, and that which has last come from the pump will occupy the lowest place, while the former supplies, in proportion as they have been longer

in the room, will be warmed up and rise to the higher parts, where an exit may be conveniently afforded by the opening of an upper sash of a window. Then, as the air expired from the lungs of persons likewise rises in a room, from the high temperature more than balancing the greater specific gravity of the gas, this will be carried away also in the general upward stream; and thus a person placed in the room will never have to breathe the same air twice over, a long-sought desideratum in ventilation, and the room will be constantly filled, at least towards its lower parts, with the coldest and freshest air which the machine can supply.

Fig. 2 is a vertical section of a room so sunk in the ground, and supplied with cold air by a pipe coming from the cooler, the arrows showing the course of the air in passing through the room, and out at last through the window.

This is all that is required for the complete cooling and ventilation of the majority of rooms in India; but in some, as we hinted above, additional means are needed for the purpose of *drying* the cold air.

A method of effecting this without heating the air, is by exposing it to metallic surfaces at a lower temperature, when the moisture in the air will be condensed and deposited on the cold metal. This may be brought about by passing the air, after its escape from under the spring valve of the cooler, through another worm of pipe in a tub where the water is kept always at a slightly lower temperature than the air, either by having a second pump compressing other air more than the first, and then allowing it to bubble through the water of the drying tub, or by dissolving in it continually large quantities of saltpetre and sal ammoniac, one of the most useful of freezing mixtures, as the salts, on evaporation, recrystallize separately; and the same stock may therefore be used over and over again indefinitely; besides which they are both found in great abundance in India. It is only necessary to have a person occasionally to throw the salts into the tub; and drawing off the saturated water, expose it to the evaporating influence of the sun and the wind, or, in default of those, to a fire.

In fig. 3, a representation of the dryer of the cool and expanded air is given. It is merely a thin copper tube, open at both ends, and immersed as to its middle in a tub of water, to which the re-

frigeration is to be applied. At the lowest bend of the pipe, after it has left the barrel, is a stop cock, to draw off the water which may be condensed under the tube, and the air may then be allowed to enter the room and be breathed by its inmates.

This completes the apparatus, and the whole is shown in plan and section, in figs. 4 and 5. A light roof is here thrown over the bullock mill, pumps, and tubs, and is continued over the room to be cooled, as a second roof with a space for the wind to blow through, is so excellent a defence against the heat of the sun. The mill is of the simplest form, and such as is now generally made in this country in iron, and of a portable form, under the name of a 'horse work," as used for thrashing machines; the pump, pipes and valves would of course also be made here, and would not be difficult of transport; while the water-tubs would be easily made on the spot by Indian carpenters, and in a form best fitted to the local peculiarities.

To make all this for the first time, and to add it to a house already built, may seem somewhat expensive; but looking at it in an *à priori* sort of view, there does not seem so much to be done as if, to a simple house where rooms should be garnished with nothing but doors and windows, it was proposed to add chimneys, fire places, grates, fenders, fire irons and chimney pieces.

The complete proof, however, and that which is so much to be desired, is in the actual making and applying of such an apparatus, and if private persons be afraid of trying new experiments, and are content to lay the flattering unction to their souls, that by moistening the hot and rarified air with wet mats, or by merely agitating it with *punkahs*, and setting it in motion by winnowing machines, that they are thereby cooling and condensing it, and bringing it into a similar state with the cold and invigorating air of their native country;—then it would seem to be a duty of Government, which has established public hospitals in those climates for the cure of the sick, to adopt any method, which, while it is neither expensive nor difficult, yet promises certainly to supply one of the desiderated means of cure, and to meet the very cause which has sent almost all the patients to the hospitals. At present, such patients must either die there in the hot atmosphere, or are sent home at great expense. What the number may be of these latter

I know not, but conclude that they can only be reckoned by hundreds; while the cost of the passage home of three or four individuals only, would be abundantly sufficient for the making of the first experimental machine.

Here, however, I must leave the matter, having neither the time nor the means to prosecute it farther, and will merely conclude with the notice of a few suggestions which arise from the foregoing facts, and which may be enumerated as the following corollaries :—

Cor. 1. On a mode of producing heat by mechanical force, and which may be possibly useful in many cold countries where wind and water power may be abundant. Frictional heat has been employed in some of the American mills, by making two plates of iron rub against each other under water: but this is by no means so profitable an application of power as by the compression of air, and by having a coil of copper tube in the room, and compressing the air only $\frac{1}{5}$th of its bulk, a heat of 360° Fah. above the external temperature would be obtained.

This manner of producing heat was illustrated by Sir J. Herschell, in a note to his "Treatise on Natural Philosophy," rather, certainly, as a theoretic principle, than in a practical way; but as I was led by it to the method of cooling air, I am bound to acknowledge my obligations. The first person whom I am acquainted with, as having proposed the method for any industrial purpose, is the Rev. Dr. Adamson, the Principal of the South African College in Cape Town; but I am not aware of his having entered upon any inquiry into the thermotic effect of compression, and the size consequent of the windmill which he would have to employ to heat a house of certain size.

When however, the heat is wished to be applied at once to the air which is breathed and fills the room, another plan may be profitably employed.

Let there be a coil of pipe as before, in a vessel of water outside the house, and let the pump be used for the purpose of extracting the air out of this pipe, at the opposite end of which there is to be a very small hole, at which the air may enter, but not so quickly, or in such quantity as it is extracted at the other. The consequence of this will evidently be a rarefaction or expansion of

the air in the tube; and the result of that is a lowering of the temperature. But it will soon be warmed up again, by the conduction and radiation of the pipe, to the heat of the water, or to its original temperature; and then, on being extracted by the pump, and thrown out into the atmosphere, it will be compressed to its original density: and will then rise above the heat of the surrounding atmosphere, to a degree proportioned to the compression so occasioned. The warming is thus produced at once where it is wanted, and has not, as in the former case, to be communicated slowly by conduction and radiation through the copper, from air on one side to air on the other; a very slow plan, on account of the small conductive power of gases.

Cor. 2.—In preparing and fitting the tropical air for the purposes of human life, we have hitherto considered only its affections as to heat and moisture; but there may, doubtless, be many gases and finely divided substances diffused through it, giving it many of its unhealthy qualities. Chemical analysis has not yet been able to detail them, but that is rather from the comparative rudeness of the methods, than from the non-existence of the extraneous matter; for the sense of smell may often be powerfully affected, as with the scent of plants, and yet a chemist is unable to discover anything different in the air immediately round a plant, and at a little distance from it. One reason of the non-success which has attended analysis of air, would seem to be the small quantities of air usually operated upon; so small, indeed, that it is not to be expected that the foreign substances should make themselves appreciable in the nicest balance.

Our cooling machine, however, forms at once an apparatus in which air may be analysed on as large a scale as may be desired; for it is only necessary to half fill the worm pipe in the cooling tub with such chemical fluid as the ærial impurities may be expected to combine with; and the machine being put to work in the usual way, will pump all the air through the fluid, and to an extent of several tons weight of air in the course of the day; so that then the smallest admixture of any foreign substance would have so accumulated its effect on the fluid, as to be most probably sensible to ordinary chemical examination.

Cor. 3. If what has been said in the early part of the paper of the difference between air, cool merely to the feelings, and that which is cold to the thermometer be true, i. e. that the former being really high in temperature, and merely feeling cool to the skin by being agitated by a fan, or mixed with watery vapour, is rarefied to the full amount of its real temperature ; and so forms a weak and diluted sustenance for the lungs; while the latter being really low in temperature, is dense, and gives, proportionately, concentrated food to the breathing organs ; if this be true, which it cannot but be, then it follows, that air mechanically compressed, and breathed in that state, may be very beneficial in many cases of disease, when the lungs may be very small, or may in part be destroyed by consumption or other malady ; for by continued compression, as much oxygen may be contained in a cubic inch of the compressed air, as in a hundred of the ordinary pressure and temperature of the atmosphere. To carry out the principle in such a manner as to be adapted to all cases of temperature and pressure it would be necessary to have a small air-tight room, made probably of iron, connected at one end with the pipe coming from the escape-valve of the cooling room, and having a similar valve at the other end. The reason of not making the pump force the air at once into the room, is, that the temperature would thereby be too much raised ; but by having a greater compression in the worm cooler than in the room, the latter may be supplied with air of any desired temperature and pressure ; and Mr. Petrie's table, given above, will show exactly the pressure to which the two escape-valves should be set, for any particular case.

SCIENTIFIC INTELLIGENCE.

On Hail Storms in Cochin and Travancore.

By Lieutenant General Cullen.

1. In the Report for 1855 of the British Association for the advancement of Science is a paper by Dr. G. Buist, of Bombay, on Hail Storms in India, and in which it is observed, " while Hail " Storms are frequent along the Western shore of the Bay of Ben- " gal; from Surat south to Ceylon in corresponding Latitudes " and Altitudes on the Malabar Coast, Hail is a thing nearly un- " known."

2. The subject had engaged my attention soon after my arrival on this Coast in 1841. I learnt that, Hail was, in some parts of Cochin and Travancore, of frequent, and in fact of regular annual occurrence; chiefly in the Great Break or opening in the Ghats at Palghat lat. 10° 30', but also occasionally on other parts of the Coast nearly as far S. as Cape Comorin.

3. I experienced a violent Hail Storm in 1845 while travelling across the Cardamom table lands of Travancore in lat. 9° 45' S. hail having fallen *on the very same day* at Ootacamund on the Neilgherries 80 miles N. W. as (Captain Horsley of the Engineers informed me) also on the Pulney mountains about 50 miles N. E.; on the Sirroo Mullays near Madura, as well as in the Palghat opening at Chittoor and other places, all forming one continuous line from S. E. to N. W.

4. Hail Storms are also, I understand, of frequent occurrence on the Table lands of the Colungode mountains forming the Southern wall of the Palghat opening; also on Uttree Mullay in the chain of Ghats in the latitude of Trevandrum 8° 28' S. in the months of March, April, and May; and during the present year Hail fell at numerous villages in the low country of Travancore from Thodawully in latitude 9° 55' to Coolatoray in latitude 8° 20', all the localities being from 10 to 20 miles or more inland but nowhere 200 feet above the Sea.

5. But it has been to the frequent occurrence of Hail in the vicinity of *the Palghat Gap in the Ghats*, and in the adjoining low Districts of the Cochin Sircar, that my attention has been chiefly directed, having had regular reports made to me for several years past.

6. Hail Storms in the Palghat opening seldom extend to the Eastward so far as Polachi in the Coimbatore District, 70 miles from the Sea at Ponany; rarely indeed occurring beyond the Talook of Chittoor which is about 55 miles from the Sea, and about 500 feet above it, in fact are limited chiefly to the middle of the opening especially to the Cochin Talooks of *Chittoor* and *Nemari*, and from thence in a W. S. W. direction through the Cochin Districts of *Pullianoor*, *Wurrakancherry*, *Nellawye*, *Talapilly*, towards Chowghat, and occasionally but rarely to the S. of Tritchoor

7. A Hail Storm occurred in February 1853 at Tripoontoray, the capital of Cochin, which is only about 7 or 8 miles from the Sea and not elevated 10 feet above it; and another in February 1852 at Trickoor 4 or 5 miles S. Tritchoor, about 50 feet above the Sea.

8. The Hail Storm met with by myself on the Cardamom table lands was on the 1st of April 1845 at a place called Peermode nearly in the middle of the table land about 3,200 feet above the Sea.

It commenced about $4\frac{1}{2}$ P. M. with thunder, lightning, *heavy rain*, and wind, *followed almost immediately* by a heavy fall of Hail which covered the ground. The temperature of the rain was 48°, that of the Hail in a tumbler 29°.

	Dry bulb.	Dew Point by Daniell.
At $9\frac{1}{2}$ A. M.	........74°	....70°
4 P. M.	.........70°	....Not observed.
5 ,,	........67°	....64 after the Hail Storm.

9. Hail Storms are however not unfrequent in these months, on the higher parts of these table lands to the N. E., near the Pulneys, at altitudes of 5,000 feet, are so severe occasionally as to seriously injure the crop of Cardamoms for the season: the ground stated on such occasions to be completely covered with hail stones, many of them of the size of a small hen's egg.

10. Of the Hail Storms on the high land of Uttree Mullay, at 4,600 feet in the vicinity of Trevandrum, the following may be noted.

In 1850 March 31st at 10 A. M. lasted ½ an hour, size of grapes.

	Dry bulb.	Wet bulb.	Diff.
11 A. M.	69	66°	3°
11½ ,,	67	65	2

1855 February 24th 3½ P. M. This Hail Storm was preceded by a vivid flash of lightning followed immediately by a heavy peal of thunder, and accompanied by Hail which lasted ½ an hour. Hail of all sizes from that of a marble to that of Pepper corn.

1856, March 21st, from 2½ to 3 P. M. of various sizes.

	Dry bulb.	Wet bulb.	Diff.
9 A. M.	66½°	64°	2½°
4 P. M.	67 °	65	2

1858, February 28, Hail from 3 to 3½ P. M.

	Dry.	Wet.	Diff.
9 A. M.	60°	59°	1°
4 P. M.	64	63	1

1858 March 3rd, Hail from 3 to 4 P. M.

	Dry.	Wet.	Diff.
9 A M.	64°	62°	2°
4 P. M.	64	63	1½

11. On the Cardamom table lands and on Uttree Mullay at altitudes of 3 to 5,000 feet, it will be observed that the wet bulb was always within* 2° or 3° of the temperature of the air, whilst in the Palghat opening only 500 feet above sea, where Hail is still more frequent, and although it is the "*cool season" on the Eastern Coast*, there prevails the most *intense heat and dryness.*

12. On the 2d March 1851 when in Tents at Oyacaud about 25 miles S. W. of Palghat at 1½ P. M., with a dry and hot Easterly wind, and the Dry bulb at 96°, no deposition could be effected with Daniell's Hygrometer at 36°,† after an immense expenditure

* Owing perhaps to at that altitude the prevalence of a moist stratum of air, caused by the ascent of the moist Sea breezes at those hours in the afternoon.

† Col. Sykes notices a depression of 61° on the 16th February 1828 at Dound in the Deccan. Philosophical Trans. for 1850.

of Æther equal to a depression of 60° below the temperature of the air. A Wet bulb fell to 62, equal to a dew point of 29°*, but it is probable that with a more delicate Thermometer it might have fallen to 61° equal to a dew point of 24°†, a degree of dryness of itself almost sufficient perhaps to produce congelation of the drops of rain before they reach the ground.

13. Kaemptz adverts to instances of the fall of *hail* in the *lower strata* of the atmosphere, whilst *rain* only fell in the *more elevated regions* of the same locality, and adds " these observations, " which *seem* to establish a presumption that hail is *formed* or " *increases* in the *lower* regions of the atmosphere, are difficult of " explanation." Yet passing through any considerable depth of so dry an atmosphere as that of Oyacaud would probably materially *promote* by *evaporation* if it did not originate the congelation of the drops of rain.

Humboldt " Cosmos" Note No. 203, Vol. I., observes that " the " drops of rain as they pass through the lower and warmer strata " of air have their temperature somewhat raised but which is again " compensated by the loss of heat which the drops undergo from " *evaporation* from their surface."

14. Nor is the instance at Oyacaud a very extreme one, for depressions of the Dew Point from 45° to 50° (equal to Wet bulb depressions 30° to 35°) are common throughout the months of February, March, and April. I subjoin a few observations for the immediately preceding month of February 1851, all taken nearly in the middle of the Palghat opening.

Feb.	Tempr. Dry.	Tempr. Wet.	Tempr. Diff.	Dew Point. Calcd.	Dew Point. Obsd.	Saussure. air.
5	89	69	20	58	47	55
9	89	65	24	48	42	×
10	90	66	24	50	42	×
11	94	67	27	49	48	51
18	94	70	24	56	49	57
19	93	69	24	55	49	58
22	97	62	35	27	47	52
25	98	67	31	45	44	48
27	90	65	24	48	43	47
28	95	68	27	51	47	49

15. Humboldt in his " Asie Centrale" notices a depression of 50 degrees of Fahrenheit in the steppes of Siberia as " l-aplus

* Or by Lloyd 31° 8.

† ——— 27° 5.

" grande secheresse qui ait eté observé edans les basses regions de " la terre." I did not record my Saussure* at Oyacaud, but 6 days previous, on the 25th February, and in the same vicinity, I observed that it stood at 5 P. M. at 48°, the Dry and Wet bulbs standing on the same day at 97° and 67° a difference of 30° = to a Dew Point of 47°.

16. In fact the heat and dryness of the Easterly winds in the Palghat opening, in the months of February, March, April, are fully equal if they do not exceed that of the land winds at Madras in the months of May and June; and they are succeeded here, as there, sometimes as early as 10 or 11 A. M. by exceedingly strong sea breezes from the W. varying as regards the hour of arrival, inland, according to the distance from the sea, and to the collision of these two winds so differently constituted in regard to temperature, vapour, and electricity may perhaps in part be ascribed the thunder storms that so often occur. The natives of those districts have a belief of the kind and attribute the thunder storms and sudden falls of rain to the meeting of the dry winds of the Eastern and moist winds of the Western countries.

17. Whilst the Dry and Wet bulbs at Oyacaud, 35 miles from the sea, were on the 2nd March 96° and 62° they stood on the same day at Cochin on the sea shore at 80° and 76°. The land or Easterly wind continued on that day, to blow at Oyacaud till past 4 o'clock; a light sea breeze setting in only at 6½ P. M., but it had reached Tritchoor 20 miles nearer the sea by nine A. M., thus taking 9 hours to pass over an interval of 20 miles. The vast mass of vapour almost in a state of saturation which in this season rolls in from the Western Coast with a velocity in general of from 10 to 15 miles per hour, on meeting with the intensely dry air in the centre of the Palghat opening which has an equal velocity to the Westward, may well be supposed to give rise to those changes in the normal conditions of the atmosphere which are followed by thunder storms and falls of Hail.

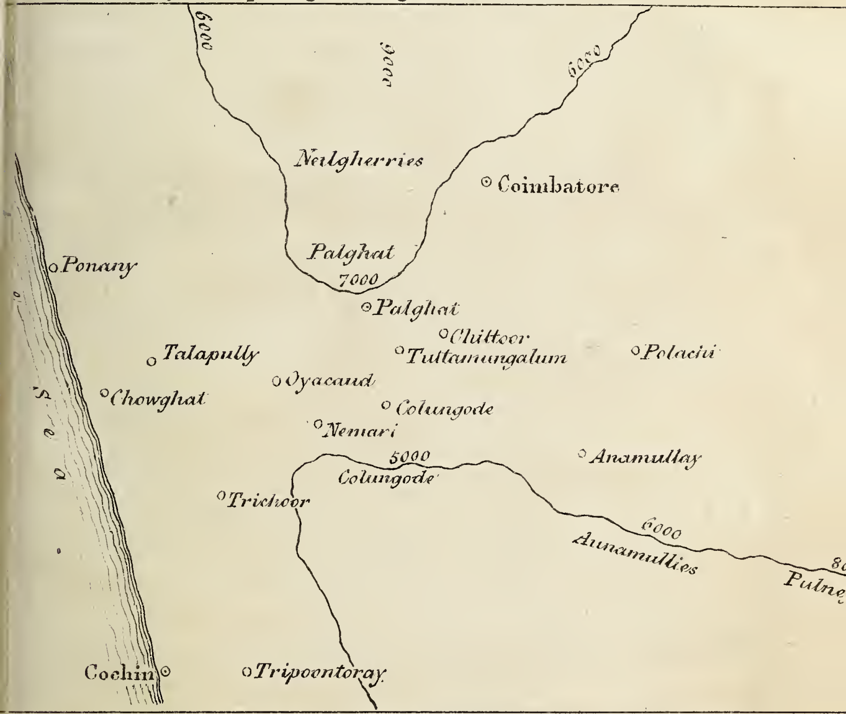
18. I have a large collection of observations of the fall of rain, and of the state of the Hygrometer, in the Palghat opening, as well as in many other localities in Travancore and Cochin,

* An instrument received from Paris.

which might possibly be useful in these investigations, but they are not at present in a state for presentation.

I may, however, advert to the very remarkable physical outlines of the tract of country under review as doubtless having along, with other causes, an important influence in contributing to the several phenomena.

The Palghat opening is an abrupt rupture in the line of Ghats about 25 miles in width and at about 50 miles from the sea coast at Ponany, the opening running due E. and W.



The N. side of the opening is formed by the precipitous group of the Palghat and Neilgherry mountains from 7 to near 9,000 feet in altitude; the southern face or wall being formed by the equally precipitous range of Golungode and Animalli mountains from 5 to 6,000 feet in altitude, prolonged some 50 miles farther to the eastward by the Pulney mountains from 7 to 8,000 feet above the sea. These two systems of high land forming one vast

funnel reaching on the N. nearly as far as Madras, but to the S. terminating with the Pulneys.

I find that of 33 hail storms on my record

4	fell in	February.
10	,,	March.
15	,,	April.
1	,,	May.
1	,,	June.
2	,,	August.

In February the winds are E. or N. E. and blow fairly into the funnel and over no high land; but in March and April drawing well round to the S., they must necessarily in great part pass over the high Pulney, Animalli and other groups of mountains experiencing great depression of temperature, without perhaps leading to actual deposition, but thereby still farther contributing to the formation of rain and hail by collision in the Palghat opening with the moist sea breezes from the westward.

The highest temperature at Madras in March is about 90°, wet bulb 70°=to a Dew Point of 60°. In passing over the Pulneys, 7,000 feet, the temperature would be reduced to 67°.

Hail Storms.

1848.

April —One at Waddakancherry, 10 miles N. of Tritchoor. Over a large tract of country, some of the lumps as large as hens' eggs,

1850.

March 16th, 4 P. M.—Prottencherry, Nunniote, Choliacaud, Bundy, Thavalum in the Chittoor Talook, size of marbles.

,, 31st, —Uttree Mullay Ghats, 25 miles N. E. of Trevandrum. Hail storm from 11 to 11½ A. M. Size of Peas....Wind N. E. strong.

	11 A. M.		11½ A. M.	
Hydrometer....	Dry	Wet	Dry	Wet
	69	66	67	65
	3		2	

1851.

April 12th, 5. P. M.—Iyloor, Nemari, Teeroowagode, Wallanghy, Wittanesherry Deshoms in the Chittoor District, size of marbles.

	Dry.	Wet.	Dew Point.
1 P. M.	93-74-19	....	$67\frac{1}{2}$°
6 P. M.	85-74-11	....	69°

1852.

Feby. 20th, 5 P. M.—Trickoor 4 or 5 miles S. of Tritchoor, size of carbine ball.

May 31st, 2 P. M.—Tirroovellamilly, Pambady, Canaracote, &c. Northern frontier of Cochin territory, size of beetle nut, lasted about 8 minutes.

Same day at Muchat and Nellawye, about 10 or 12 miles N. of Tritchoor.

1852.

June 26th, 3 P. M.—Same places as above, size of musket balls, lasted 12 minutes.

Aug. 29th, 11 A. M.—Tirroovellamilly, Pambady, Canaracote, &c. size of musket ball, lasted 6 minutes.

,, 30th —At Shalacurray, lasted 6 minutes.

1853.

Feby. 27th, 5 P. M.—Tripoontooray, 8 miles from sea and same level.

April 16th, $3\frac{1}{2}$ P. M.—Tuttamungalum, some, size of limes, others of marbles. Winds easterly.

	Dry.	Wet.
10 A. M.	82....	79-3.
4 P. M.	90....	78-12.
6 P. M.	90....	78-12.

Extract from a report from Surveyor Anderson.

" We had the shower of hail stones here on the 16th April last at about $3\frac{1}{2}$ P. M., 3 or 4 loud claps of thunder first, and almost immediately the stones began to drop very fast in succession, some about the size of a lime and of irregular form, and others quite round, and continued about $1\frac{1}{2}$ hour without ceasing, during

which time the ground was strewed all over and appeared one mass of white.

"Upon further enquiry that I made I was given to understand that two days previous* rain fell towards the eastern Talooks, viz., Woodmulcutta, Pulney, &c., in the Coimbatore and other adjacent villages when none fell here. The hail shower extended only up to Chittoor 3 miles on the E., Codoovoyoor 3 miles on the W., Palnagarum 1½ miles on the N., Puttanehaive 3 miles on the S. The hail shower was not felt at Colinjumpanay, Nulleapilly, 6 to 8 miles E. or at Moolaythoray. It seems to have rained within a limited space, and extending chiefly E. and W. The people about this place say they never witnessed such large sized stones."

* 14th April.

1855.

Feby. 24th, 3½ P. M.—Uttree Mullay.

Thunder storm with vivid lightning followed immediately by fall of hail, which lasted for ½ an hour. The hail stones of various sizes, from that of a large lime to the size of peas, Dry Wet.

1856.

March 21st —Uttree Mullay.

Hail from 2½ to 3 P. M., 4 sizes, from that of beetle nut to that of peas.

	Dry.	Wet.	Diff.
9 A. M.	65½....	64½....	1.
4 P. M.	67	65	2.

April 11th, Putticaud, 5 P. M.—Hail of various sizes, largest size of a small lime.

		Dry	Wet.	
At Tritchoor....	4 P. M.	91°....	77°....	14°
	6 P. M.	89	77	12

1857.

March 16th, —Valum Thavalum, extreme N. of the Chittoor District, 5½ P. M., for ½ an hour, size of Musquet ball. Rain, but no hail, at Chittoor 12 miles S. and where the Hygrometerwas at

	Dry.	Wet.
4 P. M.	..83..........	..76-7
6 P. M.	..80...........	75-5

April 4th, 4. P. M.—Moolathoray, Curryputtythoray, Nellimett, Nellithoray, Combalathorra, Eritherpally and Nellapilly.

Largest, size of Marbles.

	Dry.	Wet.	Diff.
4 P. M.	90°....	70°.....	20
6 P. M.	84	75	9

Extract of letter from Surveyor Anderson, dated Moolathoray 5th.

"These parts were visited by a heavy shower of Rain yesterday evening accompanied by Hail Stones which fell in great abundance, and some almost the size of a good large egg, the direction was from Nulleapilly, Moolathoray, Neddapoony, Erthampuddy, and Poodoor, but none fell at Colingumparray, Chittoor, or Tuttamungalum, although there was a fall of rain, the size at Nulleapilly was only about that of a small gooseberry."

1857.

April 22nd, —Tallapully, Western frontier of the District near Chowghat, 4 P. M., lasted 1st hour, size and shape of Tamarind stones.

	Dry.	Wet.
4 P. M.	...90°.......	71°-19
6 P. M.	...82	71-11

1858.

February 28th, —Uttree Mullay 3 P. M., lasted ½ hour, sizes from Marbles to Peas.

	Dry.	Wet.
9 A. M.	...60	59-1
4 P. M.	...64	63-1

March 3rd, —Uttree Mullay, 3 P. M., lasted till 4 P. M., size of Marbles.

April 14th, 7 P. M.—Nellapilly, Chittoor, Nemari, distance between the first and last places 15 miles. Hail (accompanied by rain), size of Marbles. Hail and rain day previous at Coimbatore.

	Dry.	Wet.
4 P. M.	90	80-10
6 P. M.	85	77-8

1859.

March 26th, 2 P. M.—Colinjaparah, Coolookaparah, Palaniapullum, Hail with rain for ¼ hour, size of Marbles. The larger Hail Stones weighed ¼ to ⅜ rupee.

,, 28th, 2 P. M.—In 3 Villages of the Curracolum Adigarom 6 or 7 miles N. of Trevandrum.

,, 29th, 5½ P. M.—Nadkanee (3000 feet) S. face or Rampart of Palghat opening, fall of Hail, size of small marbles.

1859.

March 30th, 4 P. M.—Hail at Condoor, Eerattipettah, and Poonjat, 25 miles E. of Allepey, size of marbles.

,, 30th, Chooreeparah, 4 P. M. near the bottom of the Colungode hills, for 6 minutes, size of small marbles.

April 5th, 1 and 2 P. M.—Thodawully, 30 miles E. of Cochin near the Ghats, lasted half an hour.

,, 12th, 4 P. M.—At Poodishary and Murroothumparah, about 3 miles S of Chittoor, size of beetle nut.

,, 14th, —About this date a fall of hail at Coolatoray, 22 miles S. E. of Trevandrum.

,, 19th, 4 P. M.—Nadkanee on the Colungode mountains at 3,000 feet, size of marbles, white colour.

,, 19th, 3 P. M.—Colinjaparah, size of marble.

Surveyor Anderson thus describes this fall of Hail.

"I beg leave to inform that on the 19th instant at 3 P. M., there was a strong shower of rain here, with a heavy wind, and after the lapse of about 15 minutes, hail stones about the size of a pigeon's egg fell in large numbers, weighing about 1 rupee's weight, and on enquiry I was given to understand that there was very little rain at Palghaut, Chittoor, Nellapilly, and Moolaythoray and other places, and no hail whatever in either of the above places was discovered. I believe no hail fell further than about 2 miles east of this place. The hail was of a clear white colour resembling crystal, and of various forms and shapes; there were

also several heavy and loud peals of thunder, which killed a bullock, and struck some large trees which were thrown to the ground. The whole lasted for 2 hours and then ceased. Yesterday there was a pretty good shower of rain, but no hail."

From Mr. Anderson, 23rd.—" I beg to state that since I last wrote, I have learnt that a very heavy fall of hail occurred on the 21st beyond Codayvoyoor up to the foot of the Colungode hills, (south range) an interval of 10 or 12 miles, so much so that it was heaped up in large quantities all along. The inhabitants stated that they never witnessed the like before. I am collecting more information on the subject, and shall give a more detailed report."

1859.

April 21st, 2 P. M.—Vallakolum, Pullianoor Proverty, size of marbles.

" 22d, 3 P. M.—In 3 villages of the Curracolum Adigarom, 6 or 8 miles N. of Trevandrum, also at Areenaud for 15 minutes, also at 4 places in the Marrooghil Adigarom of Neyattengherry.

" 27th, 3 P. M.—On Uttree Mullay with strong wind and thunder lasted a full hour. Hail fell also same day at the Attyaar 2,000 feet in the plains, but not below at Caviattencoodul.

In 1840 a hail storm stated to have occurred at Tritalla within 10 miles of Ponany, not 30 feet above the sea, and to have extended as far S. as Chowghat, 15 miles south, as well as many miles easterly, stones as large as pigeons' eggs did great damage.

Hail also stated to fall occasionally as far W. as Pullum Shatanoor, at Muncurry and at several other villages in the Palghat opening within the British territory, but of which I have no particulars.

Earthquakes in Southern India.

(Communicated by Government.)

Letters from T. J. Knox, Esq., Officiating Collector of Salem, dated 20th December 1859, No. 174, and 27th January 1860, No. 11.

" I have the honor to report for the information of Government, that I have received a report* from my Head Assistant Collector, Mr. Boswell, that at Tripatore between 5 and 6 A. M., on the morning of the 17th December 1859, there was a distinct and palpable shock of an earthquake very generally felt. It forcibly shook the house where the Head Assistant Collector resides, the doors being jerked somewhat violently and plaster fell from the roof. The shock was a single one, and not repeated, but the rumbling sound which accompanied it lasted for 30 seconds and appeared to the ear to move straight away unlike the sound of thunder.

* Dated 17th December 1859.

" 2. Mr. Boswell also mentions that a similar sound as of an earthquake was distinctly heard there about 5 P. M. on 30th November, which might be compared with the roll of a heavy train of Artillery passing. On both these occasions the sky was clear and fair.

" 3. No damage of any kind appears to have occurred."

" I have the honor to inform you that 3 shocks of an earthquake were felt at Salem and Peddinaickenpolliem on the night of the 17th instant, Tuesday; the first shock was felt at 10 P. M., the second at 12 P. M., and the last one at 4 A. M. I have heard of no accident having occurred.

" 2. Peddinaickenpolliem is 24 miles distant from Salem to the Eastward. I have not received a very particular acccunt, but should I hear any interesting facts connected with this natural phenomenon, I will duly report them."

Letter from J. D. Robinson, Esq., Acting Collector of North Arcot, dated Mahéndravádi, 7th February 1860, No. 31.

" I have the honor to append free translations of two native reports just received. The shock therein described appears to have been very partial, as nothing of the kind was noticed in the Palar

táluqs, in which I am now making circuit, nor have any reports of such an occurrence reached me from other parts of the district.

"Translation of a Telugu Arzi, from Sitaramaya, Police Amin of Tripati; to J. D. Robinson, Esq., Acting Collector of North Arcot, dated 3rd February 1860, No. 3.

"As I was holding my kach'hárí yesterday evening at 5 o'clock P. M., I felt the shock of an earthquake, which lasted for the space of a minute, and taking its course from east to west. The concomitant rumbling noise resembled the noise occasioned by a railway train going at full speed.

"2. It appears from enquiries that the shock was felt by the inhabitants of the villages in the neighbourhood of Tripati, who give the same account of it as above described.

(Signed) SITARAMAYA,
Police Amin."

"Translation of Arzi, addressed to J. D. Robinson, Esq., Acting Collector of North Arcot, by Syed Isak, Tahsildár of Chendragiri.

"I beg to report that on the evening of the 2nd instant, about 5 o'clock, while holding kach'hárí at kasba Chendragiri, I was startled by an extraordinary sound as of thunder travelling rapidly underground from north to south. The sound was audible for the space of one minute, and during that time the ground trembled and the shock was distinctly felt. On making enquiries, I learned that the shock took its course from the foot of the Tirumala konda, a hill seven miles north of Chendragiri kasba, and travelling southward terminated at Thorno Kumbala, a village seven miles south of Chendragiri. The shock was felt west as far as Pakala, some 16 miles off, and to the north-west as far as Bímavaram, 10 miles distant. If I hear any thing further worth mentioning, I shall immediately communicate the same to the Huzur. No damage was done to person or property."

Letters from R. Davidson, Esq., Officiating Collector of Ganjam, dated Berhampore, 29th February 1860, No. 59, and Chitterpúr, 29th March 1860, No. 79.

"I have the honor to inform you, that between 11 and 12 o'clock in the night of Saturday the 25th instant, the shock of an earth-

quake was distinctly felt by the European and Native community at Berhampore. The vibration, which was from west to east was accompanied by a loud rumbling noise, which appeared to last for some seconds. I have called on the táluq officials to report whether the shock was felt elsewhere in the District, and will communicate the result."

" Adverting to my letter No. 59 of the 29th February last, I have the honor to inform you that the earthquake was felt in many other parts of the District.

" On the 24th instant, the Head of Police of Vishamagiri (Chinna Kimidi) reported that on the 23rd the country within eight or ten miles of his station was visited by a hail storm, when hail stones, the size of Palmyra fruits, fell in great abundance. No damage is as yet reported, but making all due allowance for exaggeration, as no doubt from the description given, the stones were of very large dimensions. I consider the circumstance worthy of being brought to notice."

Eight years' observations upon the effects of the Groynes (twenty in number) with which is an attempted exposition of the theory of the Madras Surf, submitted to the Commandant and Chief Engineer. By CAPTAIN J. MCKENNIE, *Deputy Master Attendant.*

1. The above stone Groynes (which are situated between the Southern extremity of Fort Saint George and North of the boatmen's Village at Royapooram extending over more than a mile, North and South of the line of Beach) have produced the effect expected of them by many persons, from the commencement viz., to give a greater base of sandy Beach in advance of the coping stone for operations with the shipping ; at the same time, it is my humble opinion that it would have been better had not the stones been taken away from the inner parts of the Groynes (but joined and cemented with the Bulwark) as the operations advanced seaward.

2. Previous to these useful works being sanctioned and commenced, oftentimes little or no Beach was left at some places, and that so abrupt, as to render it difficult to the boats laden with cargo, as well as dangerous to the lives of passengers in accommodation boats, by throwing them off their seats, from the violence with which they were impelled on shore against the uneven and perpendicular hummocks along it, which, it is presumed, were chiefly formed by the sudden opposition which the waters met within the erection in 1821 of a Bulwark (consisting of a revetment of 16 feet by 9 and stones brought from a great distance being placed over it) by Colonel DeHaviland of the Engineers, aided probably by the advancing strong sea, meeting and stopping the weak receding one, thereby the former preventing the latter carrying the sand back again to seaward.

3. The longest Groyne is opposite Messrs. Arbuthnot and Co.'s projecting out directly seaward, causing the widest part of Beach, namely 100 yards and closely approaching the site where several vessels have of late years been wrecked (including the ill-fated "Salimany" in 1850) and which may through this process be eventually recovered, which is highly desirable, as they are thus long so many dangers to the boats. The 100 yards before mentioned is a clear reclaim of Coast, as it was always remarkable that before the Groyne at that place was erected not 1 yard thereabouts could be depended upon for beaching of the boats.

4. Although at the commencement the experiment was doubted by some officers belonging to the Scientific Corps, the great advantages gained by the erection of these works must now be as apparent to them as they are admitted by others. Not judged by fair weather criterions, but principally from the experience of no bad effects of the hurricane in 1846 upon the Groyne previously constructed opposite the Nawab's palace. Also from subsequent gales, the force of which has been felt both perpendicularly as well as obliquely to the shore. The only evil to be apprehended, as far as I am aware, from a severe storm, is a temporary steepness of Beach, but certainly I do not expect an encroachment of the sea.

The advantages of the Groynes are as follows.

A sandy Beach as above specified being permanently secured, enables the Masula boats and Catamarans at all times to be berthed and ready within their prescribed limits, which before could not be done.

Affording a smooth and clear way for taking up and down cattle, &c. (landed or shipped) over the Bulwark.

Repairing and making new boats.

Embarking and disembarking troops and their baggage.

Merchandize too, is now no longer exposed to such great risks as hitherto. No more pipes of the best wine are stove in against the stones; no more bales of superfine cloth damaged by salt water ; nor need we see any of the wholesale destruction generally to miscellaneous property formerly occurring, for want of sufficiency of Beach.

By making room for all floatsams and jetsams which for the want of more Beach used to be strewed on the high road much to the inconvenience and danger of conveyances and pedestrians.

By affording a wider ground work and protection to all the noble Beach buildings which are occupied as Court Houses, Public and Mercantile Offices, Banks, and private residences, and which had previously been endangered by the encroachment of the sea on a lee Coast, half the year ; even the Bulwark itself had not been sufficient to prevent the sea washing over the Beach road, and finding its way into the lower apartments of houses in its vicinity during gales of wind. Another fact may be here mentioned, namely, at a later period off the Marine Villa, where the sea at one time had encroached so much as almost to undermine the Governor's Bungalow there; and to save which, the Master Attendant's Department was urgently called upon on the 19th December 1847 to secure a number of laden Masula boats to seaward to serve as a temporary barrier. Itself proves how incalculably serviceable the system of Groynes is to the margin of a coast which is so little above the level of the sea, (only I believe 6 feet at some places) and in a military point of view the formation of a new Beach outside the Fort, answers as a subsidiary means of strengthening the Ramparts of Fort Saint George. If not out of place, I would here refer to the utility of

Groynes in Europe (where the tidal effects are greater than in India); there I am told, they are extensively employed both for the defence and recovery of lands, or still nearer this, at Coringa and Vizagapatam, at which places, they have, I understand, been introduced under Colonel Cotton's direction with the like effect as at Madras.

By affording a healthful promenade which is taken advantage of by hundreds of poor residents of Black Town of an evening.

By permitting a more free and wholesome discharge of the drainage and sewerage of Black Town by carrying further to sea, under covered drains the unhealthy effluvia arising therefrom. In a sanitary point of view, therefore, the people on shore are equally concerned and benefited with the shipping interest afloat.

By allowing either the old high Beach road to be widened, or a new one made over the series of Groynes outside of it. The former has been partly executed under Lord Harris' rule, from the Sea Custom House to the Railway Terminus.

By relieving the Supreme and Small Cause Courts and Magistrates' Office of much of the noise from the surf, the resound of which is lessened by its increased distance from the shore. This had hitherto been a source of much annoyance to the Judges, Magistrates, and Suitors, having business at those places,because they could not hear distinctly what was said.

5. It is true that the Boatmen are always afraid of their Boats being dashed by the waves against these Groynes, and many accidents at first happened; they are, however, now better understood and guarded against, consequently accidents are rare.

6. It may be observed that there is a greater deposit of sand on one side of the Groynes than on the other, according as the monsoon is North or South. When the North prevails there is more on the North than the South side, and when the southerly wind blows, vice versa. I measured an angle of 13 yards in favor of the weather side of one Groyne and the measurement at another (south of Messrs. Parry and Co.'s) gave double that result which seems to confirm the theory set forth in this respect; at least advanced in the absence of any other within my knowledge.

7. Following the laws of nature, the wind accelerates current,

surf and sand* until they are arrested by the approximating Groynes, immediately around which, stationary deposits of sand are thereby formed and accumulate, whilst the water by itself unchecked continue to flow and pass on by the ends or heads of these projectors (that is to be the lee side of them) where they again stir up the sediment at the bottom and a reaction of all of them together taking place, these conjoint movements occurring in the manner, I have attempted to describe, cause, I conceive, those INDENTATIONS which are visible on the lee side of the Groynes, but which is not the case on the weather side of them. The Groynes running out as straight lines too from the Beach, instead of being curved, may also give a facility to the disturbing causes above mentioned. How far to seaward these local actions extend before meeting with opposition, I could not pretend to estimate, neither does it seem necessary at present to enquire. It might, however, be supposed that at no great distance from the shore there is no accumulation of Sand Banks; on the contrary, the sand shifts about as it is controlled by the elements above it. It is hardly requisite to observe that the wind, current, tide and surf all invariably run one way in these roads, that is in the parallel where the shipping ride.

8. It may not be irrelevant to ask the question how these improvements effect the shipping? Years ago, it is said by the oldest inhabitants that the Beach extended nearly as far out as where the ships now ride (between which and the shore there was a cocoanut tope) and as the sea encroached upon the land, so the shipping anchored nearer. When the Groynes were commenced and advanced, the Beach in proportion increased, thereby in some degree affecting the safety of the *inner* anchorage, which does not now allow room for a ship to wear should she cant wrong when getting under weigh, but Vessels can always shift their berths further out as compelled by circumstances, and the new Port Regulations now allow of their anchoring in one fathom deeper water, without incurring extra Boat hire, that is to say nine fathoms. Here I may mention that the ordinary declivity of the Beach was about

* I also add tide because it is always under the influence of and accompanies the three forms except in calm weather when it fluxes and refluxes East and West, or more correctly to and from shore.

1 foot in every nine from the shore; and that 1,200 feet distance from the Coping Stone corresponded with 25 feet depth of water where the Breakwater Buoy is placed being the result of soundings, and measurement taken by Monsieur Peron, Projector of a former Pier in 1845, and myself with a lead and levelling instrument; but since an artificial slope has been given to the Beach by the Groynes, I have found a difference which will undoubtedly be experienced in all other relations with the shore.

9. Although of remote importance perhaps, yet, before concluding, it is a theme for speculative opinion what further effects may be caused by these Groynes. As the sea has been bodily resisted, what course does the forced water take ? what distance does it run, and when does it find its level ? Time alone can satisfactorily decide the point I presume, and must it not be expected, after allowing for solar evaporation that the great body of opposed water does find its way *back* again somewhere ? should it return over the Bars at Ennore, Pulicat and Coringa during the Southerly Monsoon and over those at the Adyar, Cuddalore and Porto Novo during the North, the navigation of those backwaters would be considerably deepened and improved.

10. The extension of the Beach also opens a superior mode of supplying water to the Shipping with more convenience, less labour, delay and cost, by having more depôts or cisterns extending along the whole line of Beach, so that instead of the former slow plan of only loading one Boat at a time and part of the year dead to leeward half a dozen Boats with casks could be filling. The Navy Transports, English, Country Vessels and Donies all being served at one time, and from more weatherly positions. Formerly in times of war and other expeditionary urgent service, the demand for water could never be met fast enough, an evil now partially remedied by the introduction of more watering places, but which might be made even more complete if more were established North and South of those at present in existence.

11. In erecting any more Groynes, experience has shown that the proper length of time is of the first and greatest importance to determine, some of those at present in existence are evidently unnecessarily long, and give an unnatural configuration to the line of

Coast, whilst they may have an injurious effect by turning the current on particular points and lead to an error in the calculation of the boatmen when crossing and recrossing the surf, which might prove dangerous to passengers in the boats. Others again are too short to be of the use to the extent required, as demonstrated by some of them having been washed away almost as soon as laid down and part of the Beach with them. These opinions were entertained and facts witnessed especially by the late Master Attendant in his time, who remarked that when the sea and surf have been high, they have forced themselves round the inner terminus of the Groynes, especially the weathermost one, and washed away and destroyed a large portion of the soil which had been formed round them.

12. The form and position of the Groynes are the next in importance for consideration. Although I am aware there is still differences of opinion upon the former, there need be none regarding the latter, as close observation clearly points out where erosions of the Coast take place and what sites are indispensably necessary for the erection of future Groynes if any be contemplated.

13. In concluding, I have to explain why I have taken upon myself the self-imposed task of recording these daily observations, which is simply because I am daily employed between one Groyne and another, and the officer who was entrusted with the Superintendence of the Groynes candidly informing me that his urgent duties prevented him doing so himself, and further assured me that he thought my remarks would be interesting to read, and the ex-Chairman of the Chamber of Commerce also considering they would be more so if published.

A description of the Buildings in the Ginji Fort. By CAPTAIN E. A. FOORD, *District Engineer of South Arcot.*

(Communicated by Government.)

I had the honor to acknowledge the receipt, on the 15th of October last, of the Deputy Chief Engineer's letter to yourself, calling for precise information regarding the buildings in the Ginji Fort.

I was then inspecting works between 50 and 60 miles from Ginji, and it was not till three weeks afterwards, on my return, that I was able to commence a Survey of the Fort and buildings. In this duty, I reported on the 1st of December the delay occasioned by the monsoon, and that I was obliged to leave my Estimate-maker behind to go on with the Survey, which had become a slow and tedious operation, on account of the number of offsets. I was only called upon to report on the buildings, but these are so intimately connected with the past history of the Fort, that, to avoid further reference, I considered it necessary to submit a Survey of the Fort accompanied with a brief description, plans of the buildings, their present value ascertained from careful measurement, the probable cost of repairs, and any further information which my acquaintance with the locality for five years enabled me to give. I trust, therefore, the delay will be considered satisfactorily explained and somewhat compensated for.

2. The Fort of Ginji consists of the upper and lower Forts, the former on the top of three separate hills, each rock in itself a citadel, connected at the base by walls nearly 60 feet in thickness and faced with compactly fitted blocks of granite, at present in good preservation, and by a ditch 84 feet in breadth, which form the lower Fort. The rocks marked A and B in the Survey are the two most important from their natural contour. They are ascended by steps and have a complete set of fortifications on the top, which, owing to the difficulty of access in some places either from trees or displaced stones, could not be surveyed. The buildings on them will need no separate description, being similar to those in the lower Fort to be presently described in detail. Again, the former of these two rocks is the more remarkable being in fact the citadel, situated on a granite rock of considerable strength, about 800 feet in height and perpendicular on all sides but one, to two-thirds of its altitude, whence to its summit it is perpendicular on all sides, and the communication to that part cut off by a deep chasm 24 feet broad, over which a drawbridge was formerly used. The ascent to the summit, where the fortifications and buildings are situated, on a tolerably level space, over-grown with high hill grass is now made by the venturesome at one of the lowest points of the perpendicular sides, by means of creepers, ropes and bamboos. Every

means has been adopted to increase the natural strength of this rock by the construction of massive walls along the precipitous edges and shelves, the utility of many apparently doubtful, whilst the task could only have been effected by an immense sacrifice of life. At the base of this hill is the inner or second Fort with walls, bastions and other works quite as formidable, if not more so than those forming the outer Fort.

3. The buildings in the most perfect order are two large rectangular granaries built of rubble stone work with brick arches, the whole plastered. One is a single room 82½ by 29 and 46 feet 7 inches in height to the crown of the arch. The other building consists of a spacious entrance passage with a room on either side 60 by 28 and a third at the end of the passage at right angles to these, 81 feet by 28, each of them 39 feet in height. The walls are above 5½ feet in thickness. A short flight of steps from the passage leads up to the three doorways and a similar flight on the inside into the rooms. There are apertures in the roof for filling these granaries up to the top, after as much grain as possible had been stored by means of the doors. The roof which is accessible by flights of steps from the interior, is surrounded with a high parapet completely loopholed. The present value of the larger building is ascertained to be Rupees 5,190, and that of the smaller, of one room, Rupees 3,758, and my rough estimate for repairing them amounts to Rupees 500 and 200 respectively. There are two or three Storehouses of this description on each of the two hills before mentioned, and it is worthy of remark that the brick arched roofs are in a better state of preservation on the hills also than the flat stone ones.

4. The most interesting building is a ruined Hindu Pagoda surrounded with the usual high wall of cut stone, some very elegant and elaborately carved pillars support the flat stone roof, especially around the raised places to which the idols were brought upon festivals as well as secluded parts where they were kept. The idols, and a great many of the ornamental stones capable of being removed, have at some time or other been taken away, though the removal must have been attended with considerable difficulty, with no roadway except over the steps of the Pondicherry and Trinamallie gates. The decay is chiefly owing to the growth of banyan and other large

trees and creepers upon the roof and between the joints of the walls, but Pondicherry has done its share in the destruction of this Pagoda, at what period it is not certain, but the report of Natives would fix it to within a comparatively recent one. The plunderers dismantled the roof, in places, for the sake of the handsomely carved pillars, some of which may be now seen lying on the ground at Pondicherry. There have been also miscellaneous plunderers from various petty Pagodas, which have been restored or adorned at the expense of the Ginji Pagoda. In the recent clearing of jungle, sanctioned by the Chief Engineer to facilitate the approach to the buildings, the cutting of some trees and roots only caused more stones to fall. In some places the roots have become so interwoven with the masonry that it would be impossible to separate them, and the only hope of saving these interesting ruins for a while is to leave them alone, clearing only the bushes and trees which block up the approaches to them.

5. Next is an old Mosque, insignificant in size, with the roof supported on 25 small brick arches on octagonal pillars. The centre arches are cracked by the growth of banyan drops into the interior. In front of the building is a paved court, with a basin 9 yards square in which a fountain formerly played. The walls are defaced with scribblings, and the building is used frequently for storing Indigo, and it often becomes the resort of cattle, especially during showers of rain. The exterior is the soundest looking part of the whole.

6. The most curious structure is a rectangular building of six stories, situated on one side of a square court which has a covered verandah all round. The walls are cracked and the building much disfigured. Being a singular looking edifice, a drawing of it has been prepared.

7. Two ranges of buildings close to the last appear to be worthy of attention, and probably to have been the lines for the troops. A Plan and Section of these is also submitted. The whole of the compartments are more or less in want of repair; of some, the roofs have fallen in; in others, the pillars or walls have given way, whilst others are sound. I valued the two ranges of buildings at Rupees 2,200 and my Estimate for restoring them, amounts to Rs.

5,500, but they might be rendered waterproof and useful, if no regard is paid to uniformity of repairs, for a great deal less.

8. There are a variety of other small buildings and curious pieces of sculpture (and what is remarkable, free from any thing obscene) interesting to the visitor but not requiring separate mention. The two tanks shown in the Plan are said to be of some fabulous depth. Foundations of houses are to be met with in different directions, and there is abundant evidence of the search for hidden treasure within every building. The village of Ginji, at present very small and about three-quarters of a mile from the Fort, was formerly an important village, situated close under the eastern wall without the Pondicherry gate. I have never been able to discover traces of a christian burial ground, though the French buried so many Europeans at Ginji, and I have only found one small Powder Magazine. Judging from the hollow sound at places, there must be a number of subterraneous passages and buildings. I have lately found what I consider must be the entrance to one of these passages leading apparently to the old village outside and commencing under a modern ruined building of two stories, contiguous with the Pondicherry inner gate. This building was probably the French Commandant's quarters.

9. At the foot of the hills, without the Fort, are numerous old Mandapams, square tanks and pillars, but the only work worthy of notice, and that is equal to any thing to be seen at Ginji, is a structure comprising twelve lofty and elegant columns, each a single piece of granite. A drawing of these pillars was forwarded by me to the Collector nearly two years ago, when suggesting their transfer to Madras for the Neill Testimonial.

10. The neighbourhood of Ginji until the last few years was considered deadly feverish, a shelter for thieves, and a den for wild beasts, but the commencement, five years ago, of a new road from Tindivanam to Trinamallie viâ Ginji passing through the Fort and the thickest part of the jungle, and now forming one of the main roads of the District has made such a wonderful opening and change in this part of the country, that the place is no longer feverish. Whilst more recently the admirable system of Police Tannahs and patrols, introduced by Mr. Taylor and actively carried out by Mr.

Puckle, has, together with the opening of the road, in the first place, driven the robbers from their stronghold and virtually extinguished highway and gang robberies in these Táluqs ; and in the next place, it has mainly contributed to more and more land being continually taken up by the road side, a fact of itself the best evidence of the improvement effected. It was whilst Ginji remained an isolated spot dreaded by all, that the Fort and buildings became a prey to any who coveted the valuable store of finely worked ornamental stones.

11. But the removal of the stones and destruction of buildings has been put a stop to. An order by Mr. Hall, three years ago, prohibited the removal not only of ornamental, but even of the rough stones fit for building purposes lying about in abundance in the Fort ; except, as regards the latter, for the use of Public Works. The Fort has been included in the charge of the new road passing through, and a watcher appointed to look after it.

12. I have now the honor to submit a proposition for converting the Ginji Fort into a Depôt for the sale of Salt. The large granaries, the long ranges of buildings supposed to be the lines, and several more in the neighbourhood, would store a considerable quantity of Salt. Whilst other ranges of buildings might be cheaply constructed, with the ahundance of material on the spot, along the ramparts of the second Fort, within which on a reference to the Survey, it will be seen these buildings are situated. The ramparts of the outer Fort would be available also for the same purpose. The interior area of the Fort is nearly one-third of a square mile and the whole could be easily guarded. The three gates might be blocked up, and the thing would be done. Ingress and egress should be permitted only by the road passing through the Fort, and gates might be placed at either end under the walls. The distance from the Markánam Pans is 37 miles, the back-water and the only two intermediate rivers are bridged and the principal roads branching from Ginji are one to the west by Chengumah to Krishnagherry and the Salem District, at present the route by which thousands of bullocks are employed conveying Salt ; secondly, to the North by Chetpat to Arnee, and thirdly, by Tiagar Drüg to Salem. The greatest quantity of Salt conveyed inland from the Markánam Pans

is by the main road through Ginji. Carts, which arrive from the North and South at Tindivanam would have only 17 miles to go to Ginji and be able to start again in various directions, instead of going 22 miles to Markánam which leads to no place. The Head Assistant Collector stationed at Tindivanam would be midway between the Pans and the Depôt, or again with the re-distribution of Táluqs, if Ginji was included in a Deputy Collector's charge, as the Depôt for the sale of Salt, it would claim precedence as his place of residence ; temporarily, at least, on account of the buildings, as there are others, besides those named capable of being converted into a Kachari or dwelling house. But the large granaries, if not required for Salt, might be converted to almost any use ; the thickness of the walls would allow beams to be inserted for the purpose of dividing the building into stories.

13. I have the honor to solicit the submission of the above proposition for the consideration of Government. Persons totally unacquainted with the country, will urge that Ginji is still feverish ; but I can, from five years experience contradict such assertions. I have never caught fever at Ginji, though I have come there with fever from the dense jungle of the Trinamallie Táluq and thence proceeded to Cuddalore, the opprobrium thus falling on the fixed station.

PROCEEDINGS.

Photographic Society.

At a Meeting of the Photographic Society, *held at the School of Arts, on the* 6*th October*, 1859.

Dr. Hunter, in the Chair.

It was resolved that in consequence of great complaints having been made of the heat during the last Annual Exhibition in May, which, from the imperfect ventilation and low situation of the School of Arts, the only building in Madras available for the purpose, was at times very oppressive and unbearable, the Exhibition of 1860 should be postponed until the month of December of that year.

Some difficulty was felt in determining the best season for the Exhibition, as the cold weather being the best time for working, it was thought desirable photographers should have the full benefit of it for preparing their contributions. In fixing December 1860 as the time for the next Annual Exhibition, this difficulty will be overcome, and at the same time visitors will not suffer the inconvenience hitherto complained of.

In accordance with the above resolution, it was agreed that the following Circular should be issued :—

Circular.

The Council of the Madras Photographic Society beg to announce that the 4th Annual Exhibition will be opened in the Madras School of Arts on the 1st Thursday in December 1860.

1st.—The Exhibition will be open to the productions of all Photographers.

2.—Photographs of all descriptions which show useful applications of the Art, will be admitted for Exhibition as follows :—

Positive prints from Wax Paper, Calotype and Collodion Negatives. Positive prints from negatives of engravings. Camera reproductions of the above, specimens of Micro-photography. Positive Collodiotypes.. Plain or colored Daguerreotypes and plain or colored Stereoscopic-photographs.

3.—Members are invited to exhibit any European or other Photographs they may possess, but in every case the name of the Artist and the process should be given.

4. Positive pictures from "touched" or painted negatives must be described accordingly.

5.—All pictures should be mounted, and Exhibitors are requested to reduce as much as possible the size of the margins. The pictures must bear on the back the name and address of the Exhibitor, and must be accompanied by a signed list detailing the Articles sent, together with a statement of the process or variety of a process by which the pictures have been obtained. Exhibitors up country who may not have facilities for mounting their Photographs, are recommended to apply to the Council, who will make arrangements for mounting Photographs for the Exhibition as economically as possible, the expenses being debited to the Exhibitor.

6.—With the view of carrying out one of the chief objects of the Society, viz., the encouragement and advancement of Photography, the Council have determined to award Medals to the most successful Contributors as follows—

a—A Gold Medal for views and landscapes, open to all Amateur Members of the Society.

b—A Silver Medal for views and landscapes, open to all Members of the Society.

c—A Silver Medal for views and landscapes, open to all Photographers, whether Members or not.

d—A Silver Medal for Portraits, open to all Photographers.

The prize to be awarded to the best Contributions to the Exhibition of not less than six pictures, being the *bona fide* production of the Exhibitor.

Special Medals will also be awarded for Novelties, should the Council think them worthy of the distinction.

7.—The prizes will be awarded by a Committee consisting of a President and 4 Members, resident at Madras, who are not competitors for the Medals.

8.—Arrangements will be made for facilitating the Sale of Photographs, and all Exhibitors desirous of selling their pictures are requested to send with each picture a statement of its price.

9.—Exhibitors are requested to send particular instructions regarding the final disposal of their Photographs.

10.—The Council will use every means in their power, for the safe keeping of the Contributions, but will not be responsible for loss or damage.

11.—Contributions are solicited from the Photographic Societies of Calcutta and Bombay, and from the Societies of other localities in the East.

12.—The Council earnestly solicit the co-operation of all Photographers, whether in the Mofussil or at the Presidency; they feel assured that if all the Photographers scattered over the Presidency give their assistance to the coming Exhibition, it will do credit to Madras.

All works intended for Exhibition must be forwarded to the address of the Honorary Secretary, on or before the 15th November 1860.

(Signed) A. J. SCOTT, M. D.,
Honorary Secretary.

At a Meeting of the PHOTOGRAPHIC SOCIETY, *held at the School of Arts, on the* 21*st December* 1859.

The Hon'ble W. Elliot, in the Chair.

PRESENT.

Messrs. Cochrane,
„ Cleghorn,
„ Hunter,
Messrs. Mitchell,
and
„ Scott.

The Secretary laid before the Meeting the following Circular received from the Honorary Secretary of the Bengal Photographic Society. Members are invited to forward contributions to the Calcutta Exhibition:

CIRCULAR.

The next Exhibition of the Bengal Photographic Society, will be held at Calcutta, in the first week of February 1860.

The Exhibition will be open for all good photographs, whether sent by members of the society or by others.

The following prizes will be awarded.

1. For the best series of at least ten photographs, whether portraits, or landscapes, a Gold Medal. This prize to be open only to Amateur Photographers, who are members of the Society.

2. For the second best series of at least ten photographs, whether portraits or landscapes, a Silver Medal.

This prize to be open only to Members of the Society.

3. For the best single photograph whether portrait or landscape, a Silver Medal.

This prize to be open to all Amateur Photographers, whether members of the Society or not.

The prizes will be awarded on the recommendation of three members of the Committee, who will be appointed for the purpose.

Their decision in all cases will be final.

No contributor can receive more than one prize.

No contributor can receive the Gold Medal twice, but a contributor who has obtained the gold medal in one year, may obtain the silver medal in another. The successful contributors will be expected to send a negative, in order that the Society may print the prize photographs for distribution amongst members.

By order of the Committee,

H. Scott Smith,
Hony. Secy. Bengal Photographic Society.

It was brought to the notice of the Meeting by Mr. Elliot that there are many native inscriptions in various parts of the Presidency at Mysore, Ganjam and other parts of the Northern Circars, also the Fresco Painting at Seringapatam, which are exceedingly interesting in a historical and antiquarian point of view, and he suggested that it would be doing great service to science, if Photographers throughout the country would bear this in mind, and take copies of any such inscriptions they might happen to come across in their excursions, forwarding the same to the Society to be added to their collection of photographs, so that they might be preserved as a record.

Mr. Elliot also remarked that there are several of the old portraits in the Banqueting Hall, which would be well worthy of being photographed, and that some of them would doubtless be highly prized

were copies of them printed for distribution to Members. Among the rest he instanced a portrait of the late Duke of Wellington as a young man, when he first came to this country before he attained his great celebrity, and a portrait of the Abbé De Bois.

Mr. Mitchell mentioned that he had lately been engaged in preparing Albumenized paper for printing, and he wished to bring to notice certain difficulties he had met with. The chief thing to be avoided in preparing this paper is the formation of streaks, and it has been recommended by some, as the best means of preventing them, to exclude all currents of air in the room in which the papers are hung up to dry. Mr. Mitchell's experience however showed him that more than this is required. He at first prepared his papers by laying them gently and slowly on the surface of the Albumen, in such a way, as to exclude air bubbles, allowing each to remain about half a minute, and then raising them slowly in the manner they are put on. Mr. Mitchell found that mainpulating in this way, even with the greatest care, most of his papers were still spoilt by streaks. It then occurred to him to try the effect of lifting off the papers from the Albumen as quickly as possible, and this practice he found to answer the purpose perfectly, the papers being then smooth and free from streaks.

Dr. Hunter exhibited to the Meeting a large and varied collection of European Photographs, among which were some fine Landscapes by Gustave Le Gray, R. Fenton, A. Laurenant, Lamb of Aberdeen and Morghan of Bristol, Views of many of the old Cathedrals, Abbeys, and antiquities of England and Scotland. Among these were York Minster, Ely Cathedral, Bolton Abbey, Lincoln Cathedral, Melrose and Roslyn, Kenilworth, and a few other fine ruins. Also a number of Landscape Views in Wales, Aberdeen, Dumbarton, Stirling and the Lothians. A fine series of Botanical Photographs, some of them of a very large size, by Ross and Thomson, representing chiefly the wild plants and weedy banks of the neighbourhood of Edinburgh. Several pictorial bits of nature very artistically selected by Henry White of London. A few of the prize landscape Photographs by Lyndon Smith, remarkable for the delicacy of atmospheric effect; also an instantaneous picture by Henderson, showing very delicate gradations of tint in the sky and foliage. It was certified that 1-20th of a second was the time of ex-

posure with dry collodion, but that 90 hours were required for the development. The collection also contained some fine studies of Trees, taken of a large size by the waxed paper process by B. B. Turner, and smaller ones from collodion negatives by Morghan of Bristol and Fenton, one of the best of these was a group of trees in Kensington Gardens. There were also a few copies of paintings, drawings and engravings by ancient and modern Artists, statues from the antique, and a few landscapes and views of celebrated buildings in France and Italy.

Mr. Cochrane exhibited some very fine architectural Photographs from Paris and Rome. Copies of some frescoes and paintings by Raphael and other Artists, and a few good Photographs of statues; among the latter were a group of the Laocoon from the Vatican, and a statue of Eve with the apple.

As the President of the Society is now about to leave the country on his retirement from the Service, it was resolved that a General Meeting should be held on Thursday the 5th of January, for the purpose of electing a new President—when all Members are invited to attend for this purpose. It was also proposed by Dr. Cleghorn, seconded by Dr. Hunter and carried unanimously, that a special vote of thanks be given to the Hon. Walter Elliot for his valuable aid as President of the Society from its first commencement, and that the Society request the favor of his sitting for a negative portrait to be printed for distribution to all Members.

Mr. Elliot shortly acknowledged the compliment paid him by the Society, and kindly acceded to their wishes in regard to sitting for his portrait, which it was arranged he should do at one of the first Photographic establishments on his arrival in London.

At a Meeting of the Photographic Society, *held in the School of Arts, on Thursday the 5th of January* 1860.

W. E. Underwood, Esq. was unanimously elected Chairman of the Society, in the room of the Hon'ble Walter Elliot, who has left the Presidency on his retirement from the Service.

Proceedings of a Meeting of the PHOTOGRAPHIC SOCIETY, *held in the School of Arts, on the 1st of March* 1860.

PRESENT.

W. E. Underwood, Esq. in the Chair.

Col. McCally,
Dr. Hunter,
Mr. Crake,
Lieut. Mitchell,
Col. Hamilton, and
Dr. Scott.

Some discussion took place relative to the prints proposed to be distributed to members for the 4th year, when it was resolved not to make any selection of negatives for the purpose, until after the next Exhibition, which is fixed to take place in December.

The Secretary having intimated that there were still about 40 sets of the prints for distribution for the 2nd year's subscribers in his possession, it was resolved, that all prints remaining unclaimed for twelve months after their receipt, should be disposed of for the benefit of the Society.

Members entitled to these prints are therefore again solicited to intimate to the Secretary the names of parties in Madras, to whom they would wish them to be delivered with the view of their being forwarded to them. N. B.—It may be right to explain that it is impossible for the Society to take the responsibility, and be at the expense of forwarding such prints to up-country subscribers direct.

The following is a list of the prints above referred to.

1st. Portrait of Lord Harris. 2nd. Portrait of the late General Neill. 3rd. Mussulman Tomb, by Capt. A. N. Scott. 4th. Stone Car and Temple, by Dr. Neill, and 5th. Monkey god, by Dr. Neill.

The Secretary also announced having received information relative to the shipment of the prints for the 3rd year, which may therefore be expected to reach Madras in the course of a couple of months or so. This set comprises: 1st. A Portrait of Sir C. Rawlinson, by Maclean. 2nd. Photograph of Arey Scheffer's famous picture of Faust and Margueritte. 3rd. An old ruined Pagoda and Tree, by Capt. Tripe. 4th. A figure of Ganesha, by Capt. Tripe, and, 5th. St. Mary's Church in the Fort, by Lieut. Mitchell.

Mr. Crake exhibited to the Meeting a very portable and complete apparatus for taking Stereoscopic views.

The Camera was fitted with two lenses, thus admitting of both

pictures being impressed at the same instant of time, but when the object to be copied is remote, it becomes desirable to take the pictures at a wider angle, than that of the three or four inches between the lenses; the Camera then admits of the application of Mr. Latimer Clarke's ingenious arrangement for taking Stereograms with a single lens, by this contrivance, after exposing this first side of the plate, the Camera is removed in a lateral direction, without disturbing the position of the image on the ground glass, or on the sensitive surface, by this appliance the utmost Stereoscopic effect is secured at whatever distance the object is situated from the Camera.

The Negatives shown by Mr. Crake, were done on dry plates prepared by Dr. Hill Norris, and although four or five months have elapsed since the preparation of the plates, they still continue to yield satisfactory pictures, clean in their lights, and showing no indication of deterioration by keeping. Prepared Plates that have been subjected to the influence of sea air, contract a liability to spot and are much spoiled by it.

Mr. Crake kindly placed at the disposal of the Council a selection from his negatives to be made available for the next distribution of prints.

Madras Literary Society.

At a Meeting of the Managing Committee of the Madras Literary Society, *and Auxiliary of the Royal Asiatic Society, held at the Club House, on Thursday, the* 13*th October*, 1859, *at half-past* 6 *o'clock*, P. M.

PRESENT.

E. Maltby, Esq.	J. D. Mayne, Esq.
Major W. J. Wilson.	W. Hudleston, Esq., *Secy.*
G. F. Fullerton, Esq.	

The Secretary laid before the Meeting the usual Monthly Statement of the Society's Funds prepared up to the 12th Oct. 1859.

Resolved, that the above Statement is satisfactory and be passed.

Read letter from J. G. Thompson, Esq., forwarding two copies

of a paper named "Pointed and unpointed Romanic Alphabets compared."

Ordered to be recorded.

Read letter from Rev. T. Foulkes, forwarding a paper* on the power of the Tamil Consonant ற.

Ordered to be referred to the Sub-Committee of Papers.

Read letter from G. L. Forbes, Esq., Deputy Secretary to Government, forwarding copy of the Lecture on the *Geology of the Province of Auckland, New Zealand.

Ordered to be referred to the Sub-Committee of Papers.

Read Extract from Proceedings of the Madras Government, dated 27th September, 1859, No. 1492, containing an order relative to Mr. Acworth's letter regarding a piece of Rock Salt found near Kircumbady.

Ordered to be referred to the Sub-Committee of Papers.

Read letter from Captain Puckle, District Executive Engineer, Bangalore, forwarding Meteorological Observations and a table of Experiments on the strength of Timber.

Ordered to be referred to the Sub-Committee of Papers.

Read letter from Dr. Rost, Professor of Sanskrit, at St. Augustine's College, Canterbury, returning thanks for having been appointed an Honorary Member of the Society.

Ordered to be recorded.

Read Circular proposing a continuance of the publication of "Schoolcraft's History of the Condition and Prospects of the Indian Tribes of the United States."

Ordered that the copy in the Society's Library be completed.

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* Published in our last No.—ED. M. L. J.

At a Meeting of the Managing Committee of the MADRAS LITERARY SOCIETY, *and Auxiliary of the Royal Asiatic Society, held at the Club House, on Thursday, the* 10*th November* 1859, *at half past* 6 *o'clock*, P. M.

PRESENT.

The Hon. W. Elliot, Esq.—*Chairman.*

G. F. Fullerton, Esq.
Major W. J. Wilson,
J. T. Wheeler, Esq.
E. Maltby, Esq.
W. Hudleston, Esq., *Secretary.*

The Secretary laid before the Meeting the usual Monthly Statement of the Society's Funds, prepared up to 10th November 1859.

Resolved, that the above Statement is satisfactory and be passed.

Read Letter from General Cullen forwarding Correspondence of the late Mr. Adolphe Schlagintweit.

Resolved, that the papers in question be published in the Proceedings, but the Committee doubt whether they will aid the enquiries now proceeding in Calcutta.

Read Proceedings of the Madras Government containing letter from Mr. Oldham on a piece of Rock Salt found at Kircumbady, with reference to the Secretary's letter of the 17th September last, to the address of the Chief Secretary.

Ordered to be recorded.

The Secretary pointed out to the Meeting the necessity of procuring a new Press for the Book Binding Department, at a cost of about 11 or 12 Rupees.

Resolved, that the Secretary be authorised to procure the necessary Press.

Read letter from Sir C. Trevelyan to the Secretary, proposing to continue the examination of the Budhist remains at Amarávati, and requesting the co-operation of the Society.

Mr. Elliot brings to notice that a curious Paper on the subject of Amarávati was published about 1818 or 1819 in the Asiatic Annual Register by Colonel Mackenzie who first brought these interesting remains to notice. By an Extract from his Journal published in the Asiatic Researches, Vol. IX, Page 273, it appears that he visited the place in 1797, and found the whole a mass of ruins. There is good reason to believe that the structure had existed in tolerable preservation to a period shortly antecedent to the Colonel's arrival.

It appears that Venkatádri Vásareddi Náyadu, the recently created Zemindár of Chintapulli under the permanent settlement, who fixed his place of residence at Amarávati, shortly after obtaining possession of his Estate, commenced extensive excavations into the mound called Dípaldinnë in close proximity to the Town, with the expectation of finding treasure. The only object of interest he obtained was a Stone Casket or case, containing Budd'hist relics, which with other property of the Vásareddi family, is under sequestration in the Guntoor Zillah Court. Mr. Rohde, when Judge, at Mr. Elliot's suggestion, sent this Vase to the Central Museum, where it now remains in trust.

Failing in his quest for treasure, the Zemindar made use of the materials of the tope for the construction of his new capital, in which condition, and while the work of spoliation was still in progress, it was found by Colonel Mackenzie.

Colonel Mackenzie's account in the Asiatic Register, though drawn up from personal inspection, gives a mistaken view of the form and object of the structure, to which Mr. Fergusson has assigned the true character.

Mr. Elliot's excavations which only extended along one side were conducted by Ráma Prasád, then a Jemadar on his Establishment, and now Head of Police in Masulipatam.

Mr. Elliot states him to be a person of great intelligence and every way trustworthy, and considers that he may be employed with advantage to superintend any further excavations that may be undertaken.

The Committee think it very desirable that the Examination of the whole should be completed, and will with pleasure co-operate in any measures the Government may adopt.

Extract from the Proceedings will be forwarded to Sir C. E. Trevelyan, in reply to his note.

Read letter from the Rev. Mr. Kearns communicating a Paper on the examination of certain Cairns in Tinnevelly .

Ordered to be acknowledged with thanks, and transferred to the Sub-Committee on Papers for publication in the Journal.

At a Meeting of the Managing Committee of the MADRAS LITERARY SOCIETY, *and Auxiliary of the Royal Asiatic Society, held at the Club House on Thursday, the* 10*th December*, 1859, *at half past* 6 *o'clock*, P. M.

PRESENT.

The Honorable Walter Elliot, *Chairman.*

G. F. Fullerton, Esq.
W. C. Maclean, Esq., M. D.
H. B. Montgomery, Esq., M. D.
Major W. J. Wilson.
W. Hudleston, Esq., *Secy.*

The Secretary laid before the Meeting the usual Monthly Statement of the Society's Funds prepared up to the 10th instant.

Resolved, that the above Statement is satisfactory and be passed.

Read letter from the Secretary to the Library and Philosophical Society of Manchester proposing an exchange of publications.

Resolved, that the proposal be accepted and acknowledged accordingly.

Read letter from Messrs. Hermann and Robert Schlagintweit, returning thanks for having been elected Honorary Members of the Society.

Ordered to be recorded.

Read communication from the Honorable Mr. Elliot relative to letters received by him from M. Hermann von Schlagintweit and Captain Lumsden of the Artillery at Hyderabad.

Resolved, that the extract from *Captain Lumsden's letter be transferred, with the Honorable Mr. Elliot's remarks, to the Sub-Committee on Papers.

Also that extract from M. von Schlagintweit's letter be laid before Government with a recommendation that Government subscribe for a set of the Crania as a fitting and important accompaniment to the Masks already secured.

Read letter from Capt. Moloney forwarding Copy of a Pamphlet descriptive of the experiments on Strychnine and Nicotine made by Mr. Haughton.

Ordered to be recorded with thanks, the Pamphlet will be transferred to the Sub-Committee on Papers for publication.

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* Will appear in our next.—ED. M. L. J.

Read Extract from the New Zealand Government Gazette containing a Lecture on the Geology of the Province of New Auckland, by Dr. F. Hochstetter of the Austrian Frigate " Novara," communicated by the Madras Government.

Ordered to be recorded.

Read letter on the *Photographic delineation of Microscopic objects by Lieut. Mitchell, Officer in charge of the Government Central Museum.

Ordered to be communicated to the Sub-Committee on Papers.

Read letter from the Rev. Mr. Foulkes on the power of the Tamil Consonant ற.

Ordered to be communicated to the Sub-Committes on Papers.

Read letter from Mr. George Bidié proffering his services to superintend the proposed operations at Amaravuttí.

Ordered to be recorded. Mr. Elliot will reply to it.

Read letter from Mr. Lewis H. Morgan of New York to the Honorable Mr. Elliot enclosing a printed Schedule and letter in explanation of an ethnological work on which Mr. M. is engaged.

Mr. Morgan who is engaged in certain ethnological enquiries regarding the American Indian Races is anxious to ascertain whether, through their peculiar system of consanguinity and descent, any connection can be traced with Asiatic Races, and evidence thus obtained of a common origin.

The great distinguishing features of this system, which, with minor modifications appears to be universal on the American Continent, among the Indian tribes, are that *descent* follows the female line, or passes through the mother, and that the collateral lines are gradually re-absorbed in the lineal; while in the Civil and Canon law exactly the reverse is the case, descent being through the father, and collateral lines by each remove from the common ancestor becoming more distant from the lineal.

The Schedule of questions which should have accompanied Mr. Morgan's letter was unfortunately not received, but the Pamphlet will be transferred to the Sub-Committee on Papers, that copious Extracts may be published in the Journal, which may it is hoped draw attention to the subject.

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* Published in our last No.—Ed. M. L. J.

At a Meeting of the Managing Committee of the MADRAS LITERARY SOCIETY, *and Auxiliary of the Royal Asiatic Society, held at the Club House on Thursday, the* 12*th January*, 1860, *at half past* 6 *o'clock* P. M.

PRESENT.

G. F. Fullerton, Esq.
J. T. Wheeler, Esq.
W. Hudleston, Esq., *Secretary.*

The Secretary laid before the Meeting the usual Monthly Statement of the Society's Funds prepared up to the 11th Instant.

Resolved, that the above Statement is satisfactory and be passed.

Read letter from J. G. Thomson, Esq., to the Chief Secretary, forwarding a Copy of a complete Phonetic Alphabet, and Orders of Government thereon.

Ordered to be recorded—several Copies of the Pamphlet having been already received direct from Mr. Thompson.

Read letter from the Rev. James Kearns, forwarding a Packet of Papers containing Inscriptions in ancient Tamil, for presentation to the Society.

Ordered to be acknowledged with thanks, and transferred to the Sub-Committee on Papers.

Read three letters from General Cullen relative to Inscriptions and Specimens of Gold Sand forwarded, and one letter with Memoranda regarding Hail Storms on the Malabar Coast.

Ordered to be acknowledged with thanks. The Inscriptions to be transferred to the Sub-Committee, and the Mineral Specimens, with Copy of the Letter relating to them, to be forwarded to the Officer in charge of the Museum.

Read letter from T. Oldham, Esq., Superintendent of the Geological Survey, acknowledging the receipt of No. 8, New Series of the Society's Journal.

Ordered to be recorded.

Read letter from Walter Elliot, Esq., presenting to the Society twelve Numbers of the Journal of the Royal Society and two Copies of a Palœographic Alphabet.

The Secretary intimates to the Meeting that the Hon. Sir C. Trevelyan has presented to the Society the following Works.

Memoires de la Societé Royale des Antiquaíres du Nord, 2 vols. from 1840 to 1849,

Runeindskrift i Piræus. Inscription Runique du Pirée,

Guide to Northern Archœology, edited by the Earl of Ellesmere,

Annaler for Nordisk Oldkyndighed og Historié,

Det Hongelige Nordiske Oldskrift—Selskab,

Saga Jatvardar Konings hins Helga,

Manual of Ethnological Enquiry,

Notes on the Chinese Army,

and that J. D. Sim, Esq., has presented seven Volumes of " Nature Displayed" translated from the French " Spectacle de la Nature."

Ordered to be acknowledged with the thanks of the Committee to the respective donors.

At a Meeting of the Managing Committee of the MADRAS LITERARY SOCIETY *and Auxiliary of the Royal Asiatic Society, held at the Club House, on Thursday, the 9th February* 1860, *at half past* 6 *o'clock*, P. M.

PRESENT.

J. D. Mayne, Esq.	W. Hudleston, Esq., *Secretary.*
G. F. Fullerton, Esq.	

The Secretary laid before the Meeting the usual Monthly Statement of the Society's Funds prepared up to 9th February 1860.

Resolved, that the above Statement is satisfactory and be passed.

Read letter from Capt. J. McKennie, Deputy Master Attendant, forwarding some observations on the effects of the Groynes on the Beach during erection and subsequently.

Ordered to be transferred to the Sub-Committee on Papers.

Read Extract from Proceedings of the Madras Government (Revenue Department, 22nd October 1859, No. 428) with a Report from the Collector of Malabar on the management of the five Laccadive Islands, sequestered for arrears of pishcush due by the Bebee of Cannanore, also a separate Report of the Island of Menakoy.

Ordered to be transferred to the Sub-Committee on Papers.

Read letter from Lieut. Mitchell, in charge of the Government

Museum, reporting the result of a Microscopical examination of the Gold Sand forwarded by General Cullen.

Ordered that a Copy of the letter be communicated to General Cullen, and that the Paper be transferred to the Sub-Committee on Papers.

Resolved, that Thursday the 23rd Instant, be appointed for the Annual General Meeting, to be held in the Strangers' Room at the Club, at half past 6 o'clock P. M., and that a Notice to that effect be published in the Fort St. George Gazette.

AGRICULTURAL AND HORTICULTURAL SOCIETY.

Proceedings of the Meeting of the Committee, held at the Gardens, on Wednesday, 5th October, at 6 P. M.

PRESENT.

Colonel Reid, C. B.,	C. Dale, Esq.
R. Hunter, Esq.	Colonel Colbeck,
Rev. J. R. Macfarlane,	H. B. Montgomery, Esq. M. D., *Secretary.*
A. M. Ritchie, Esq.	
A. J. Scott, Esq., M, D.	

MEMBERS.

G. J. Shaw, Esq., M. D.	Amir Ud Dowlāh, Bahadoor.

In the absence of the Hon. W. Elliot, Colonel Reid, C. B., is unanimously elected Chairman of the day.

The Proceedings of last Meeting are read and approved.

The Monthly Accounts are examined and found correct.

Read the following Proceedings of the Board of Revenue, dated 27th September 1859.

Read the following letter from P. Grant, Esq., Collector of Malabar, to W. Hudleston, Esq., Acting Secretary to the Board of Revenue, Fort Saint George, dated Calicut, 15th September 1859, No. 223.

Application has been made to me by Mr. Brown of Anjeracandy, well known by his many successful endeavours to introduce useful

products into Malabar, to procure a small supply of the Jamaica Ginger which appears to have been successfully grown in the Horticultural Gardens at Madras.

1st. I need hardly remark that the Jamaica Ginger is likely to grow well and prove a valuable addition to our products in Malabar, where hundreds of tons of Ginger are annually grown.

Copy of this letter will be communicated to the Committee of the Horticultural Society with a request that they will enable the Board to comply with Mr. Brown's request.

2nd. The Board understand that the Director of the Government Garden at Peridinnia near Kandy in Ceylon, will be prepared to furnish a supply of this article should a further quantity be required for distribution.

(Signed) J. HUDLESTON,
Acting Secretary.

Resolved, that the foregoing be complied with and some roots be despatched to the Collector of Malabar for transmission to Mr. Brown.

Read the following Extract (para 6) of the Proceedings of Government, dated 14th September 1859, relative to the People's Park.

6. Mr. Brown, the Superintendent of the Horticultural Gardens, will undertake the immediate charge of these works under the directions of the Committee, drawing for this duty an additional allowance of fifty (50) Rupees a month, and every bill connected with the expenses which may be incurred on account of the Park must, prior to its submission to Government, be certified by Mr. Brown and countersigned by the Secretary to the Committe. It will then be passed for payment from the fund, in the hands of the Municipal Commissioners arising from the sale of the adjoining allotments on the esplanade of Black Town, which already amounts to upwards of 20,000 Rs. Mr. Brown's additional stipend will be paid from the same source.

With reference to the foregoing arrangement, then anticipated, the orders of the Committee have been already passed (vide Annual Report.)

Read the following Memorandum by Mr. A. T. Jaffrey, on the Nutmeg disease, &c.

MEMORANDUM.

On the Nutmeg Disease in the Straits Islands.

At Page 1314 of "Balfour's Encyclopædia," the following remarks occur anent the culture of these spice-trees. "But it is some consolation for the Proprietor to know that stupidity will not ruin him and even at the distance of thousands of miles, he can give such directions as if attended to will keep his estate in a fruitful and flourishing state."—Simmonds. This quotation would tend to a belief that it was one of the simplest things in the world to cultivate a Nutmeg Plantation. However the most convincing proof, viz. ocular demonstration, leaves no doubt but that there is a real possibility of ruin staring the Proprietors of the Plantations in Penang and Singapore, in the face; and the chances are that, unless remedial measures are adopted to arrest the present deterioration of the trees which is almost universal there is a probability that not only ruin is in view, but there is the extinction of a valuable article of commerce to be feared.

It was perfectly evident when visiting the Islands a few months ago, that some fatal malady had seized upon the trees. What cause this effect had arisen from may be difficult to unpractised eyes to discover; but judging from appearances only, not having sufficient opportunity fairly to investigate the matter, still from what was seen, the conclusion come to was, that the disease was *local* and not *constitutional;* therefore there was a hope that it could be overcome.

The first supposition was that the disease was canker and therefore constitutional, but none of the indications, of such a disease being present, could be discovered; the symptoms of this are the appearance of small blisters on the epidermis of the young shoots, and sometimes, if not always, at the base of the branches. There was no cracked or suberous appearance on any of the trees examined. It was therefore requisite to draw together from former ascertained facts what the symptoms indicated. These were the yellow sickly appearance of the foliage, the decay of the branches

here and there, and the fruit dropping off before ripe. The next investigation made was what sort of treatment had produced such results: it was perfectly evident that manuring with green manure had been carried on, the plan appeared to be to cut the grass on the Estate and the trees with it, throwing some earth over it after it had been laid on of a certain thickness. If this is correct, a more injudicious act could not be thought of.

There may be a valuable fertilizing principle, in green manure, suitable to hard wooded trees, though there is no harm in its being doubted, and no great stretch of argument would be required to prove its destructive properties, and happy is the planter who never attempted to prove it upon his trees. If a chemical Philosopher was called into question, he would not go upon the vague supposition, " that no amount of stupidity would ruin him." His action would be, by the most careful analysis, to try and obtain a knowledge of the qualities of the components, then a fair judgment could be formed. Matter of similar qualities should undoubtedly be the food of the plant analyzed. There may be error in this, plausible though it be; still the more the nature of the plant is considered, the more favourable the results, as regards the selection of manure.

These remarks are requisite to enable us to discover what the disease in question is. From the symptoms, it is evidently a *Fungus*, which has attacked the roots, and has been created by the decomposition of green vegetable matter. Though the roots were not examined, the results are such as to leave little doubt upon the subject. As a proof of the position taken up, there is in Penang a plantation, called Government Plantation which I believe has received no attention, good, bad, or indifferent for a long time back, and the trees look healthy, nothing could be plainer than that carelessness, in not having an acquaintance with the Physiology of the plant cultivated, has brought about the results now to be deplored. The disease being unseen is all the more dangerous. From the rapidity with which Fungi ramify, when once established in any soil in the Tropics, there is every reason to conclude that the soil in these plantations is thoroughly impregnated with this deadly scourge, which may be so minute upon the rootlets, as to require

in some cases a microscope to discover it. It is plain without entering into chemical details, that a large quantity of green vegetation, collected round the stem of a tree and covered with soil, is a sufficient cause to originate vinous fermentation which is distinctive from the elements it produces. One of the worst of these will be vinegar, will in all likelihood arise from the Alcohol produced; another error may arise, from collecting matter too deep around the stem of the tree, viz. the exclusion of atmospheric air from the *roots* and *collet*, or as Trevirainus calls it "centrum vegitationis," or "life knot."

If these remarks lead to an investigation of this important subject, they will have attained their end. It would be presumption to propose remedial measures with the present amount of information, but were the subject fairly and thoroughly investigated, there is every reason to think the disease might be arrested, though it is one about which very little has been hitherto known.

(Signed) ANDREW T. JAFFREY.

In publishing the foregoing Memorandum, the Committee desire to direct attention to what may be one of the causes of disease in the Nutmeg Tree.

The too free use of green manure is a very possible source of disease, and is so evitable that the further use of it might be suspended. Careful investigation will, no doubt, disclose more fully at once the cause and mode of cure of this disease.

The Committee will receive with pleasure and give publicity to any further remarks on this disease, by persons having practical experience in the treatment of it.

The following Gentlemen were unanimously elected Members of the Society.

Lieut.-Col. Adye, R. A., Major Worster, M. A., Captain R. F. Oaks.

The next Meeting is appointed to be held on Wednesday, November 2nd, when the Committee will be happy to see any Members who desire to attend. Until further orders the Committee will meet at half past six A. M. at the Gardens.

Proceedings of a Meeting of the Committee held at the Gardens, on Wednesday, December 7th, 1859.

PRESENT.

Honorable Walter Elliot, Esq.—*President.*

J. D. Sim, Esq.	H. B. Montgomery, Esq., M. D.
H. F. C. Cleghorn, Esq., M. D.	*Secretary.*
Colonel Colbeck,	

The Proceedings of the last Meeting are read and approved.

The Committee determine that the day for the next Annual Competitive Exhibition of Fruits, Flowers and Vegetables shall be Tuesday, February 21st, 1860.*

The prizes already offered and notified in their Proceedings under date April 6th, 1859, will be then offered for public competition. The following is also added to the list:—

21½.—For the best twelve Dahlias of varieties.

Further particulars will be published in the next Proceedings.

A specimen of a new and undescribed species of Isonandra, discovered by Captain Beddome, is exhibited by Dr. Cleghorn.

Read the following Report upon the systematic cultivation of the *Asclepias Gigantea,* otherwise known as Calotropis Gigantea.

This Report was forwarded to the Revenue Board and by them to the General Committee of the Madras Exhibition of 1859, from whom it was received by this Society.

REPORT.

On the cultivation of Yeroocum Cotton in Chingleput.

Referring to the Board's Proceedings, No. 455, of the 8th February last, I have the honor to report, that I immediately issued a notice in the District Gazette, calling upon the Tahsildars to furnish me with supplies of Yeroocum cotton seed, and acquaint me whether they were willing to look after its cultivation. I believe only one Tahsildar replied, that he would attend to one cawney, if instructed in the way he was to cultivate the plant, while another reported, that, do all he could, he could not induce any ryots to undertake the business. I merely mention this to show the little interest shown in the cultivation of the plant by the people of the country.

As regards seeds, there was none to be had when the Board wrote their Proceedings adverted to, and it was not till about July,

* This has been since altered to Thursday 23rd.

that I was able to procure any. At that time. and up to nearly the present moment, the plant which is a common weed came into blossom, and as much seed could be had as was wanted. I have availed myself of some spare ground in the Roshun Baugh, to plant about 6½ cawnies, but the plants do not appear to me to thrive. There are about 5,000 plants, of which 200 are one foot high, 3,000 four inches, and 1,800 two inches high. The plant is a weed and seems to grow best in the neighbourhood of old brick kilns or in uncultivated ground. The little assistance offered by the Tahsildars, the unpromising look of the young plants, and the immense quantity that is to be found growing wild in all directions, have led me to stop, any further extension of cultivation as a useless, and under the circumstances extravagant expense. The present plants, that have been sown, will not, I think, bear fruit before the middle of next year ; but the wild plants growing in my neighbourhood, will give as much produce as would probably have been realized from 50 cawnies, if the Board wish for any further quantity of cotton as a specimen than that sent to them with my memorandum, on the 14th Instant.

2. Had Dr. Shortt, the Zillah Surgeon remained at Chingleput, he could have undertaken the cultivation in that neighbourhood, but his ill health having rendered it necessary for him to go away, there was no one there to look after it, and the plantation at the Roshun Baugh is, therefore, the only one under superintendence

The departure of Dr. Shortt is a great loss for the Scientific cultivation of the plants, if it was expected to improve under cultivation, as he took an interest in the objects of the Board. Without personal interest in the matter, I do not think much more, if so much, can be expected from the plant than in its wild state.

3. As regards the Cotton, it is a most difficult matter to collect and keep it, it is so very light, that the least breath of air, drives it about and it can only be picked from the pod cleaned, and packed in a room shut off from the wind. I do not think, therefore, it can ever be cultivated for the market, even if a remunerative price could be got for it by the ordinary ryots, as they have no places where they could dry and pick the pods, and it would require an immense extent of cultivation to produce sufficient produce to pay for the erection of suitable places of refuge from the wind.

The wind and the lightness of the Cotton must always be the two most difficult drawbacks, the Cotton will have to overcome. If I had not a spare room in my house, I think, I should have found it very difficult to clean and send any specimen to the Board. I employed two men on the work for many days, and with all the conveniences and safeguards. I was able to afford the flight of the small follicles of cotton about my house, was very disagreeable.

4. I enclose a bill for ploughing and sowing the land in the Roshun Baugh, and another for the expenses attendant on the specimen, sent to the Board, amounting to Rs. 30-10-6 and Rs. 40-7-6 respectively. The former calls for no observation.

In regard to the latter, the boxes with tin covers were procured for the purpose of securing and drying the Cotton, and are available for further service. They were however insufficient in size, and on trial I don't think well adapted : low baskets with thin muslin spread over the top, being better adapted to let the rays of the sun penetrate and dry the Cotton. Throwing out these items, and confining the cost of the Cotton to the sum paid for the pods, Rs. 10-6-0, and the sum paid for picking and cleaning them Rs. 23-5-0, it will be found that Rs. 33-11-0, were paid for 8,310 pods, or say with those gathered in my own compound 8,400 pods ; and that these pods yielded by my memorandum of the 14th Instant, a fraction short of lb. $30\frac{1}{2}$, being at the rate of about Rs. 1-2-0 per lb. or more than five times the price of the ordinary Indian Cotton in the London market, where it sells at between five pence and six pence per lb.

5. At the rate of 2 annas per 100 pods, I found the yield abundant. More was brought in by the poor people, who went about gathering, than I could pick and work off, but at 1 anna, to which I reduced the rate, the yield almost stopped ; two annas may therefore be set to be the market price, at which the Board may procure, almost, if not quite as much as they could possibly wish, without the incidental expenses or trouble of cultivation ; the subsequent expenses would be common to either mode of procuring the raw article, the only difficulties are the cleaning and packing, and these can only be overcome by personal care and suitable accommodation.

6. With this information before them, the Board can judge, whether they would like any new plantations to be formed. If such

is their intention, they must necessarily be very expensive, as all labour will have to be paid for.

In the Roshun Baugh the two gardeners kept up by Government, will be sufficient to look after the plants, and with Coolies to collect the pods when they ripen will be all that are required for the future, now that the first expenses of breaking up the land have been paid for, but in a plantation in any other place, the charge for Superintendence will become a distinct item and added to the cost of the raw article.

7. If I may venture to give an opinion, I should say enough has been done, by way of experiment in planting 6½ cawnies, and that the value of the wild Cotton had best be ascertained before a further venture is made in ploughing and sowing any more fresh land.

If freight, brokerage, insurance and other charges are added to the present ascertained cost of the wild article, it appears to me, that it would become very expensive, or perhaps nearly half the price of silk which is Rs. 5 per lb, and at this price I do not think, it would be worth any manufacturers while to purchase it. The Board however, will be able to judge of this through the Chamber of Commerce.

(Signed) C. J. SHUBRICK,
Collector of Chingleput.

Resolved, that the above be brought to notice with a view to the cultivation of the plant being encouraged by Local Committees and the Officers of the Revenue Department throughout this Presidency.

The Yercoom Fibres, both the pappus and the fibre of the stem are valuable articles likely to become eventually of considerable commercial importance.

The following gentlemen are unanimously elected Members of the Society, with effect from 1st January 1860.

J. Kerakoose, Esq.
W. H. Woodhouse, Esq., Ceylon.
T. A. Phillips, Esq. C. S.

The Meeting then adjourned.

Proceedings of a Meeting of the Committee held at the Gardens on Friday, January 20th, 1860, at half-past 6 A. M.

PRESENT.

Colonel Reid, C. B.	C. Dale, Esq.
Colonel McCally.	Colonel Simpson.
J. D. Sim, Esq.	Rev. J. R. Macfarlane, and
Colonel Colbeck,	Howard B. Montgomery, Esq.,
R. Hunter, Esq.	*Secretary.*

Owing to the absence of the President, Colonel Reid is elected Chairman of the day.

The proceedings of the last Meeting are read and approved.

The Secretary intimates that, owing to the return to Europe of the Hon. Walter Elliot, Esq., the office of President of the Com mittee, must be filled up by a new nomination. The vacancy thus occasioned, in the General Committee, absorbs one of the members who became supernumerary in consequence of the alterations approved by the Annual Meeting of 1859. (Vide Proceedings dated 22nd July, 1859.

Colonel McCally is unanimously elected Chairman of the General Committee.

Resolved, that the Secretary be instructed to take an early opportunity of conveying to the Hon. Walter Elliot, Esq., the expression of the sincere regret felt by the Committee at his departure from among them, and further, of acknowledging his warm interest in, and valuable contributions to, the Gardens during the period of his connexion with them as a member of the Society.

The vacancy upon the General Committee, in consequence of the return to Europe of A. J. Arbuthnot, Esq., absorbs one other member supernumerary as before explained.

The Committee proceed to consider the arrangements relative to the Annual Competitive Exhibition of Fruits, Flowers, and Vegetables which was at their last meeting arranged to be held on Tuesday 21st proximo. It has been found on enquiry that the arrangements of the Supreme Court and Council would probably prevent the attendance of many Members upon that day. The

following (Ash Wednesday) being unsuitable, it is finally determined by the Committee that Thursday, February 23rd, 1860, shall be substituted for the day previously appointed.

The Secretary is directed to circulate, without delay, among the Members of the Society, a subscription list, to defray the expenses of this Exhibition, the management of which is placed under his control.

F. A. REID, *Chairman of the day.*
H. B. MONTGOMERY, *Secretary.*

[Meteorological Observations taken a]t the Madras Observatory from 1st October to 30th November 1859.

Depth of Rain.	Depth of Evaporation.	Remarks.
[In]ches	Inches	[Ta]ken on Sunday at 9h. 30m. A. M. and 3h. 30m. P. M. [The rain fall registered] in 24 huors is from Sun rise to Sun [rise following.]
0·087	0·150	
....	·274	
....	·326	
·853	·311	
·107	·324	
·181	·255	
....	·324	
....	·345	
....	·291	
·499	·237	
·081	·250	
....	·282	
·134	·257	
·158	·109	
·090	·259	
....	·273	
....	·448	
....	·281	
[illegible]	·344	

1859.	Barometer educed to 32° Faht. A. M. h. m. 9·41	Barometer P. M. h. m. 3·41	Thermometer corrected to the Kew Observatory's Standard. A. M. h. m. 9 41	Thermometer P. M. h. m. 3·41	Max.	Min.	Direction of the Wind. A. M. h. m 9·41	Direction of the Wind. P. M. h. m. 3·41	Depth of Rain.	Depth of Evaporation.	Remarks.
NOVEMBER.	Inches	Inches	o	o	o	o			Inches	Inches	Taken on Sunday at 9h. 30m. A. M. and 3h. 30m. P. M. The rain fall registered in 24 hours is from Sun rise to Sun rise following.
Tues. 1st....	30·044	29 933	78·3	75·5	81·0	74 6	N N E	N b E	1·114	covered	
Wed. 2nd...	·020	·888	77·8	81·2	82·1	73·5	N E	N E b N	....	0·126	
Thur. 3rd...	29 960	·865	80·6	81 1	83·7	72·3	N b E	N E	....	·221	
Fri. 4th.....	·974	·860	79·8	80·2	81·2	73 6	—	N E	....	·198	
Sat. 5th.....	·999	·893	81·1	81·5	82·8	73 1	N E	N E	....	·196	
Sun. 6th....	*30 021	*·899	*83·2	*82·5	85·0	79·3	N E	N E	....	·325	
Mon. 7th.....	29 973	29·867	82·3	82 3	84·7	72 3	N E	N E b N	0 085	N. B.—The rain fall registered in 24 hours is from Sun-rise to Sun-rise following.	
Tues. 8th....	·979	·882	83·5	79·3	85 6	78·6	N E	N E	1 077		
Wed. 9th....	30·009	·907	84·1	83·5	86 1	75 4	N E	N E b E	0·003		
Thur. 10th..	29 990	·867	82·0	82·6	84·3	76 4	N E	N E	·046		
Fri. 11th.....	·988	·885	82·5	82·3	85 3	74·9	N E	N E	·361		
Sat. 12th....	·978	·856	83·1	79·4	83·3	75·6	N E	N E	1 293		
Sun. 13th...	30·038	·931	75·5	76·8	79 1	74·5	N E	N E	1·034		
Mon. 14th..	29 995	29·874	81·3	81 9	84 4	74·0	N	N E	0·054	0·171	
Tues. 15th..	·980	884	81·7	81 5	85·3	74·9	N E	N N E	....	·230	
Wed. 16th..	·948	·848	79·1	79·4	80·0	73 5	N	N	·721	·075	
Thur. 17th..	·887	·803	78·5	75·3	78·7	74·6	N N E	N	1 951	covered.	
Fri. 18th....	·905	·798	80·6	78 5	81·9	74·6	N N E	N E b E	1·146	·044	
Sat. 19th....	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	

Meteorological Observations made at the Madras Observatory from 1st December 1859 to 31st January 1860.

1859.	Barometer reduced to 32° Faht. A. M. h. m. 9·41	Barometer reduced to 32° Faht. P. M. h. m. 3 41	Thermometer corrected to the Kew Observatory's Standard. A. M. h. m 9·41	P. M. h. m. 3·41	Max.	Min.	Direction of the Wind. A. M. h. m. 9·41	P. M. h. m. 3·41	Depth of Rain.	Depth of Evaporation.	Remarks
DECEMBER.	Inches	Inches	°	°		°			Inches	Inches	
Thur. 1st....	·896	·778	82·1	83·4	84·7	75·1	W S W	S E	·012	·157	
Fri. 2nd.. ..	·910	·810	80·5	84·1	86·3	75·1	W *b* S	N N E	....	·213	
Sat. 3rd.....	·943	·847	79 0	80 1	81·9	71·2	N	N	...	·212	
Sun. 4th....	·947	·825	76·8	80·1	81·0	69·2	N	N	...	·261	
Mon. 5th....	29·925	29·803	74 7	79·6	80·9	70·1	N N E	S *b* E		0·300	
Tues. 6th....	·945	·825	78·8	82 3	83·8	70·8	S W	S E		·226	
Wed. 7th. ..	·997	·883	81·8	83·1	85 0	73·3	S	S E		·233	
Thur. 8th. ...	30 028	·915	82·3	82·0	83 9	74·1	S E	E		·243	
Fri. 9th.....	·035	·900	80 0	82·0	84·2	73·7	N E	E by N		·249	
Sat. 10th....	·027	·917	81·8	82·5	84 6	73·9	E N E	E		·222	
Sun. 11th....	·055	954	82·4	80 8	84·4	74 7	E	E		·334	
Mon. 12th..	30·106	29·993	80 5	81·3	83·2	73 1	N B	N E		0·290	
Tues. 13th..	·081	961	79 5	80·3	81·6	73·3	N *b* E	N E		·281	
Wed 14th..	·077	·972	80 3	81·0	82·8	71·2	E N E	E N E		·328	
Thur. 15th..	·084	·989	80·0	80 7	82·7	70·9	E	N E		·251	
Fri. 16th.. ..	·085	30·009	79·3	79 7	81·8	73·5	E N E	N E		·266	
Sat. 17th....	·099	29·999	79·4	79 4	81 7	76·1	N E	N E	None.	·380	
Sun. 18th. ..	·099	993	78·7	80·7	81·9	71·2	N E	N E *b* N		·231	
Mon. 19th...	30 084	29·957	79·1	79·5	81·6	73·1	N N E	N E		0 222	
Tues. 20th..	·078	·948	78·3	78·7	81·1	69·1	N E	N E		·359	
Wed. 21st..	·060	951	77·4	79 5	81·3	69·5	N N E	N E *b* E		·213	
Thur. 22nd.	061	·955	80 1	79·1	81 3	70·3	N *b* E	N E		·240	
Fri 23rd	092	·975	79 1	79 4	82·1	70·3	N E	N E		·263	
Sat. 24th. ...	·102	·995	78·5	78·4	80·1	73 5	N	N E		·275	
Sun 25th.. ..	·103	·982	77·1	79 3	81 4	67·6	N N E	N E		·376	
Mon 26th....	30·052	29·941	78 8	79·4	81·1	75·3	N E	N E		0 179	
Tues. 27th...	·054	·935	78·0	78·5	80·8	69·7	N N E	N E *b* N		·176	
Wed. 28th...	·051	·945	77·6	78·5	79·9	67·7	N	N E		·222	
Thur. 29th..	·026	·910	78 6	79·3	80·8	69 3	N E	N E		218	
Fri. 30th....	·027	·909	77·7	79·2	80 7	67·0	N N E	N E *b* N		·244	
Sat. 31st....	·033	·915	76 2	78·0	79·6	66·2	N N E	N E		·206	

1860.	Barometer reduced to 32° Faht. A. M. h. m. 9·41	Barometer reduced to 32° Faht. P. M. h. m 3 41	Thermometer corrected to the Kew Observatory's Standard. A. M. h. m. 9·41	P. M. h. m. 3·41	Max.	Min.	Direction of the Wind. A. M. h. m. 9·41	P. M. h. m. 3·41	Depth of Rain.	Depth of Evaporation.	Remarks.
JANUARY.	Inches	Inches	°	°	°	°			Inches	Inches	
Sun. 1st....	·003	·898	75·9	76·4	78 7	66·2	N	N N E		·221	
Mon 2d....	29·988	29 859	75·8	79·1	80·1	65·1	N by W	N E		0·256	
Tues. 3rd. ..	30 026	·891	73·9	79·4	81·5	66 0	N	E by S		·202	
Wed. 4th....	·008	·913	77·3	79 5	81·2	67·0	N	N E *b* N		·211	
Thurs. 5th..	·044	·916	77·1	78·4	79·7	66·9	N	N E		·258	
Fri. 6th.....	·063	·913	75·1	78 6	79·8	64·1	N	N N E		·255	
Sat. 7th.....	·030	906	75·3	78·0	78 7	67 0	N	N E *b* E		·246	
Sun. 8th....	·022	·919	76 2	78·6	80·1	68·7	N E	N E		·290	
Mon. 9th....	30·03 2	29 935	77·6	79·1	81·5	70·2	N	N E		0 327	
Tues. 10th. .	·023	·931	78 7	80·0	81·6	68 9	N E	N E		·329	
Wed. 11th..	·054	·941	78 5	78·6	81·3	69·8	N E	N E		·364	
Thurs. 12th	·093	992	78 5	79 3	80·4	68 5	N E	N by E		·302	
Fri 13th. ..	·146	30·032	78·1	78·0	79 8	68 9	E N E	N E		·318	
Sat. 14th ...	·146	·030	77 8	77·5	79·8	72·4	N E	N E		·451	
Sun. 15th...	·098	29 977	76·5	77 1	79·9	72·1	N E	N		·256	
Mon. 16th ..	30·129	29·972	75·7	79·3	80 9	67 5	N	N E	None.	0·282	
Tues. 17th..	·105	·993	78·3	89·1	81 9	68·4	N E	N E *b* E		·411	
Wed. 18th..	·072	·937	73·3	79·1	81 0	68 2	N E	N E		·429	
Thurs. 19th.	·087	·966	77·5	79·3	80 9	65 9	N N E	E N E		·335	
Fri. 20th ...	·123	30 001	75 5	77·9	79·4	65·2	N	N E		·289	
Sat. 21st....	·107	29·981	76·1	78·5	81·1	69·3	N	N E		·351	
Sun. 22nd...	·097	30 002	77·5	80 7	81·4	69·1	N N E	E		·362	
Mon. 23rd..	30 111	29 989	76·5	78·5	80 6	68·3	N N E	N E		0 288	
Tues. 24th..	·098	·959	77·4	79·3	81·8	70·1	N	E		·331	
Wed. 25th..	·102	·987	75·2	79·4	80·5	66 1	N E	N E		·332	
Thurs. 26th	·111	30·003	75 2	79·0	80 2	62·9	N E	N E *b* N		·320	
Fri. 27th....	·103	29·966	77·6	79 5	81·2	66·5	E	N E		·337	
Sat. 28th....	·079	959	78·3	80·4	82·1	67·4	E	E		·364	
Sun. 29th ...	·082	·964	79 3	79·6	81·2	69·3	N E	E S E		·382	
Mon. 30th..	30·093	29 962	79 3	81·7	82·4	70 0	E	E N E		0 260	
Tues. 31st..	·058	·928	79·3	81·3	82 9	71·6	N	N E		·256	

Meteorological Observations made at the Madras Observatory from 1st February to 31st March 1860.

1860.	Barometer reduced to 32° Faht. A. M. h. m. 9·41	Barometer reduced to 32° Faht. P. M. h. m. 3·41	Thermometer corrected to the Kew Observatory's Standard. A. M. h. m. 9·41	Thermometer P. M. h. m. 3·41	Max.	Min.	Direction of the Wind. A. M. h. m. 9·41	Direction of the Wind. P. M. h. m. 3·41	Depth of Rain.	Depth of Evaporation.	Remarks.
FEBRUARY.	Inches	Inches	°	°	°				Inches	Inches	
Wed. 1st. ..	·047	·925	79·1	80·9	82·1	71·1	E N E	E *b* N	None.	·377	
Thur. 2nd...	·045	·917	77·3	81·8	82·8	68·4	E	S E		.235	
Fri. 3rd.....	·045	·932	73·3	81·8	82·7	68·3	S E	E *b* S		·397	
Sat. 4th.....	·085	·949	79·5	81·1	82·2	69·1	S E	N E		·224	
Sun. 5th...	·083	·951	78·4	81·3	82·1	67·5	N E	N E		·326	
Mon. 6th ...	30·059	29·950	79·2	80·7	82 0	68·1	N E	E N E		0·285	
Tues 7th....	·066	·943	77·6	80·7	82·6	67·2	N	E N E		·283	
Wed. 8th....	·060	·928	79·5	82·5	84·6	69·7	N	N E *b* E		·222	
Thur. 9th...	·021	·901	79·5	82·3	85·7	69·8	S E	S E *b* E		·255	
Fri. 10th....	·011	·895	77·3	82·3	83 5	67 4	E	S *b* E		·258	
Sat. 11th....	009	·880	77·3	83·6	84·9	67·5	S W	E S E		·291	
Sun. 12th....	.028	·892	78·4	84 0	84·3	70·0	S E	S E		.295	
Mon. 13th...	30·007	29·864	78·8	82 5	82 9	69 9	S S W	E S E		0·258	
Tues. 14th..	29·972	·850	79·9	82·3	83·7	68·5	S S E	E *b* S		·301	
Wed 15th..	30 012	897	80·7	83·4	84·7	69·3	E S E	E N E		·356	
Thur 16th..	·064	·948	80 5	82·1	84·1	72·0	E S E	E N E		.350	
Fri. 17th....	·068	·969	80 8	84 4	84·9	74·0	N E	E *b* N		·323	
Sat. 18th....	·008	·875	81·7	83 4	86·7	74 2	N N E	E *b* N		·298	
Sun. 19th....	29·960	·845	82 2	85·3	85·4	75 1	S	S E		·337	
Mon. 20th....	29 982	29·858	82·4	84·7	86·2	71 4	S	S E *b* S		0·342	
Tues. 21st...	30·013	.888	82 3	83·7	85 0	71·6	E	E *b* S		·258	
Wed. 22nd,,	29·972	·847	81·4	83 8	85·3	72 9	N E	E *b* N		·284	
Thur. 23rd..	29·958	·826	82·1	84·7	86·3	71·9	S S E	S E		·313	
Fri. 24th.. .	29·980	·842	83·1	85 4	87·0	73·1	S E	S E *b* S		·292	
Sat 25th....	29 952	·824	83·2	84·8	85·6	72·2	S	S E		·288	
Sun. 26th.....	29·918	·787	83·4	86·1	86·3	73·1	S	S E		·327	
Mon. 27th ..	29.934	29·818	84·3	85·8	89·5	74·1	S	S E		0·316	
Tues. 28th..	·984	·852	84·5	85·7	87·8	73·4	S	S E		·272	
Wed. 29th.	·949	·823	82·4	86·7	89·1	70·5	S *b* W	S E		·314	

1860.	Barometer reduced to 32° Faht. A. M. h. m. 9·41	Barometer reduced to 32° Faht. P. M. h. m. 3·41	Thermometer corrected to the Kew Observatory's Standard. A. M. h. m. 9·41	Thermometer P. M. h. m. 3·41	Max.	Min.	Direction of the Wind. A. M. h. m. 9·41	Direction of the Wind. P. M. h. m. 3·41	Depth of Rain.	Depth of Evaporation.	Remarks.
MARCH.	Inches	Inches	°	°	°	°			Inches	Inches	
Thurs. 1st ..	·943	·813	83·8	86 6	90 6	71 4	S W	S S E	None.	·316	
Fri. 2nd....	·951	·806	82·5	87·7	91·7	72 2	S S W	S E		·340	
Sat. 3rd.....	·921	·759	84·4	86·0	88·0	73·2	S W	S S E		·321	
Sun. 4th....	·914	·786	82 9	87·3	87·8	72·0	S S W	S S E		·377	
Mon. 5th....	29·973	29·858	82·5	85·4	86·3	70 8	S E	S S E		0·308	
Tues. 6th. ..	·994	·866	82 3	85·4	87 2	70·2	S	S by E		·291	
Wed. 7th. ..	·928	·795	82·5	85 0	89·3	71·0	S E	S E		·290	
Thurs. 8th..	·906	·775	83 5	86·5	88·1	72·0	S W	S S E		·331	
Fri. 9th.....	·906	·781	85·3	86 0	87·7	72·5	S E	S S E		·300	
Sat. 10th. ...	·915	·804	86·4	88·5	90·1	76·0	S	S S E		·335	
Sun. 11th...	·986	·871	86·5	86 5	87·4	75 5	S S W	S E		·328	
Mon. 12th ..	30 006	29·875	84·4	86·5	88 6	73 4	S	E S E		0·334	
Tues. 13th..	29·987	·865	83·5	86·8	87·4	72·7	E S E	S E		·330	
Wed. 14th..	30·001	·862	83 3	86 7	87·4	73·1	E S E	E S E		·300	
Thurs. 15th .	29·990	·863	84·4	86·7	87·5	73·9	S	E S E		·321	
Fri. 16th....	·978	·846	85·3	88·2	89·3	73 5	S E	S		·319	
Sat. 17th ...	·971	·828	87 3	86 7	90·3	76·9	S	S by E		·243	
Sun. 18th. ..	·940	·820	87·5	88·3	90·8	78·8	S S E	S E		·304	
Mon. 19th..	29·976	29·841	86·1	88·2	90 0	77·1	E S E	E by S		0 223	
Tues. 20th..	·988	·868	87 3	88·4	89·9	76 4	S E	E S E		·267	
Wed. 21st. ..	·953	·833	85·3	88·5	89 3	73·2	S E	S E		·297	
Thurs. 22nd	·892	·790	86·9	86 5	89 4	73·2	S by E	S S E		·327	
Fri. 23rd. ...	·918	·831	85 6	88·9	89·6	73·9	S E	S by E		·338	
Sat. 24th. ...	30 017	·916	87·3	88 5	90·6	74·9	S E	E by S		·318	
Sun. 25th...	29·987	·863	86·7	88·3	91·3	74·6	S S W	S E		·311	
Mon. 26th..	29·949	29·808	88 1	90·4	94·8	76·0	S W	S S E		0·340	
Tues. 27th..	·948	·812	86 6	89·3	91·5	75·7	S W	S E		·364	
Wed. 28th..	·945	·795	89 3	89·3	93·3	78·2	S	S		·352	
Thurs. 29th.	.924	·780	90·8	88 8	95 2	77·7	S	S E		·353	
Fri. 30th. ...	·920	·776	88·9	89 4	91·9	76 4	S	S by E		.368	
Sat. 31st. ...	·903	·750	87·4	89·4	91·3	57·5	S	S E		·316	

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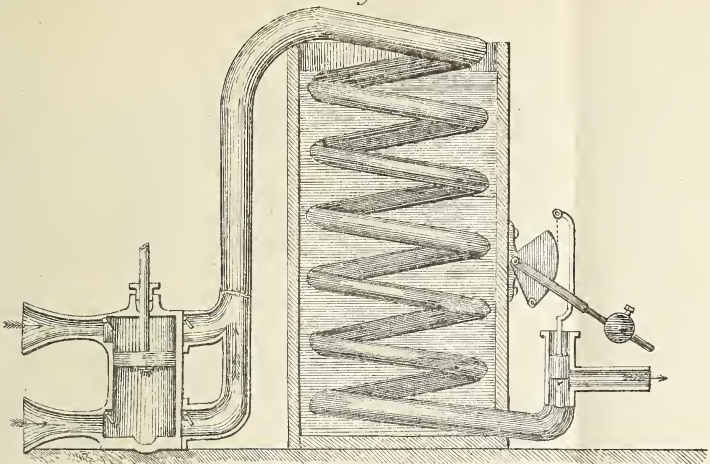
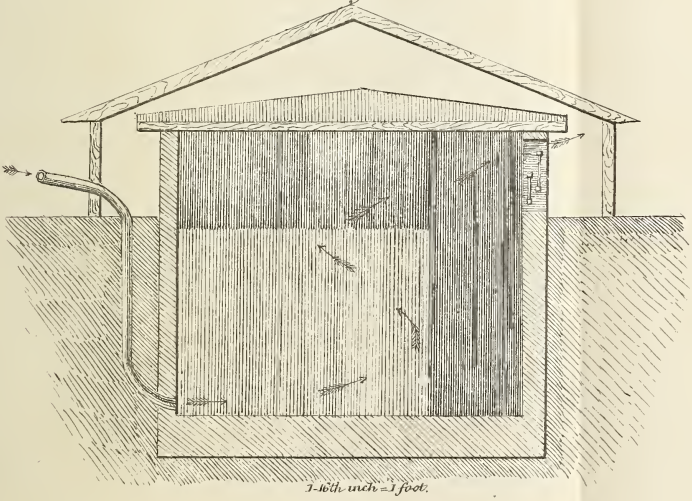
BRITISH MUSEUM NATURAL HISTORY

Fig. 1.



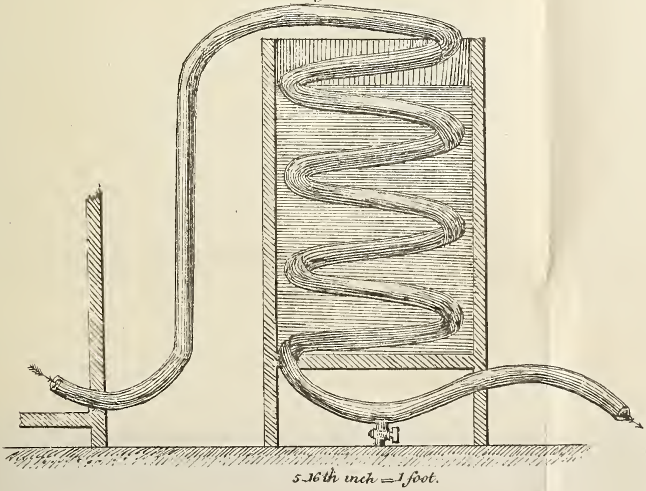
5-16th inch = 1 foot.

Fig. 2.



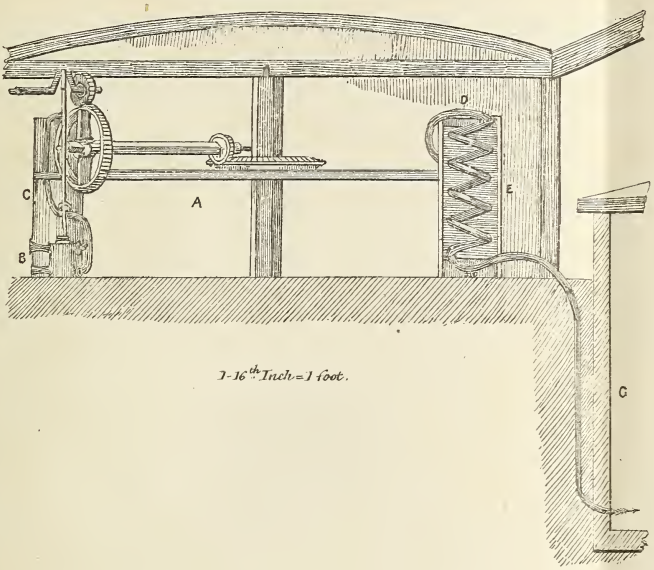
1-16th inch = 1 foot.

Fig. 3.

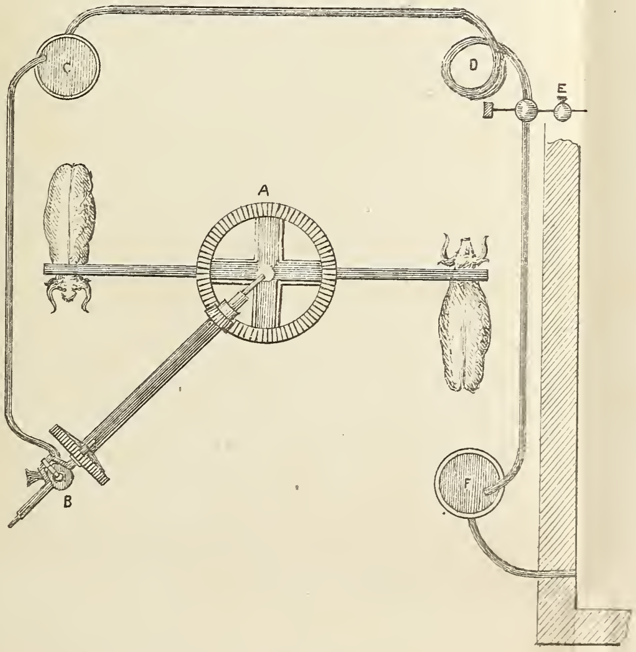


5-16th inch = 1 foot.

NATURAL HISTORY



1-16th Inch = 1 foot.



1-16th Inch = 1 foot.

Drawn by G. Winchester *Chepauk, June 1860.* *Lithd. by S. Dumphy, E.I.W.*